AN EVALUATION OF THE U.S. NAVY'S
FACILITIES ACQUISITION PROCESS

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by

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B. Arch., University of Southern California
(1967)

Submitted in partial fulfillment

of the requirements for the degree of

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P159

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ABSTRACT

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GREGORY ALDEN PARKER

Submitted to the Department of Civil Engineering on 21 January, 1976 in partial fulfillment of the requirement for the degree of Master of Science in Civil Engineering.

The Thesis presents a general evaluation of the organizational structure and the management systems the U.S. Navy is currently utilizing in the execution of its continuing building program, and identifies what the author believes are several problems which have resulted from current practices.

The organizational structure evaluated includes four (of the Navy's six) Engineering Field Divisions (EFDs) which are directly responsible for managing design production for approximately 500 million dollars of facilities (in terms of the construction value) a year and 60 subordinate offices who are responsible for administering construction contracts. These construction administration offices are co-located with customer organizations at the construction site, geographically separated from the EFD, and as such these units face different organizational pressures than those felt at the Engineering Field Division. As a result of these organizational pressures and the geographical separation of design and construction there is a significant loss in potentially valuable communication between the personnel involved in the design process and those involved in administering the construction contracts. This gap is further widened by the practice of largely managing design and construction as separate continuing functional programs. This functional rather than product orientation has led to a concentration on interim means rather than on end product performance, a problem which is characteristic of a functional organization.

The Thesis will identify the nature and extent of the gap between design and construction, examine those factors which are related to this gap, and present a method for dealing with the situation which has proven successful in other settings.

Thesis Supervisor: William A. Litle

Title: Head, Constructed Facilities Division

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XII LIST OF ABBREVIATIONS

A-E	Architect-Engineer (refers to a firm that practices architecture and or engineering)
BFRL	Basic facilities requirements list
BOD	Beneficial Occupancy Date (refers to the date the customer can move in)
CAB	Command Advisory Board
CCD	Contract Completion Date (the contractual completion date)
CEC	Civil Engineer Corps
CMS	Construction Management System (a computerized status reporting system)
CNO	Chief of Naval Operations
CONUS	Continental United States (excluding Hawaii and Alaska)
DADS	Deficiency Analysis Data System
DOD	Department of Defense
EFD	Engineering Field Division
EIC	Engineer in Charge
FY	Fiscal Year
JCS	Joint Chiefs of Staff
LSR	Logistic Support Requirements
MBO	Management by Objectives
MCON	Military Construction Navy (a category of appropriated funds which includes Navy projects only)

MILCON	Military Construction (a category of appropriated funds which includes projects from all three services)
NAVCOMP	Navy Comptroller
NAVFAC	Naval Facilities Engineering Command
NMCRB	Navy Military Construction Review Board
OICC	Officer in Charge of Construction
OMB	Office of Management and Budget
OMN	Operations and Maintenance Navy (a category of appropriated funds)
OSD	Office of the Secretary of Defense
PCE	Program Cost Estimates
P&S	Plans and Specifications
PWC	Public Works Center
PWD	Public Works Department
RDT&E	Research, Development, Test and Evaluation (a category of appropriated funds)
ROICC	Resident Officer in Charge of Construction
SIFPPS	Naval Shore Installations and Facilities Planning and Programming System
SIOH	Supervision, Inspection and Overhead
WIP	Work in Place (refers to the dollar value of construction which has been put in place)

INTRODUCTION AND KEY TO THE TEXT

The U.S. Navy manages the design and construction portion of its continuing building program through six Engineering Field Divisions (EFDs) each responsible for a separate geographical area. A little more than two thirds of the facilities the Navy designed and built in fiscal year 1975, in terms of the value of completed construction, were built within the Continental United States and over 85 percent of this workload was executed by four of the six EFDs. The work performed by these four Engineering Field Divisions will be the subject of this Thesis.

These four EFDs manage, directly from their main offices almost all the design performed for their projects. Construction contracts are administered from organizational units, (a total of 60 for the four EFDs combined) subordinate to the EFD, which are located at or near the construction site. Because of the co-location of these units with customer organizations these units face different organizational pressures than those felt at the EFD. As a result of these organizational pressures and the geographical separation of design and construction there is a significant loss in potentially valuable communication between the personnel involved in

the design and those involved in adminstering construction contracts. This gap is further widened by the Navy's practice of largely managing design and construction as separate continuing functional programs. This functional rather than product orientation, along with certain pressures from above, has lead to a concentration on interim means rather than on end product performance.

The gap in communications and the concentration on means rather than ends are two factors which have contributed to the fact that the majority of the problems the Navy faces in the execution of its continuing building program are managerial and not technical.

The Thesis will identify the nature and extent of the gap between design and construction, examine those factors which are related to this gap, substantiate that the major problems faced are managerial, and present a method for dealing with the situation which has proven successful in other settings.

The Thesis is divided into three sections, Section A, Background, Section B, Research Findings, and Section C, Summary and Recommendations.

The first section is developed primarily for the reader who is not familiar with the Navy's design

and building process. This section describes the full context within which the design and building process is conducted, by first identifying the major organizational players in the facilities business and then describing the Navy's planning and budgeting cycles along with identifying the organizational units that manage design and construction.

The second section states the hypothesis and presents the research findings. The research findings are presented in three chapters the first of which deals with the influence and direction exerted on the design and construction process from above. The remaining two chapters present a comparative analysis of the differences and similarities between the Engineering Field Divisions and their construction contract administration units.

The third section which includes three chapters will summarize the findings with relationship to the hypothesis, describe in detail the primary recommendation and list other specific recommendations concerning both the central conclusion and the other related issues dealt with in the Thesis.

The Thesis is organized so that it can be read in three different ways. The first, which requires the normal start to finish procedure, is intended for

the reader who is interested in the complete study and is not familiar with the Navy's design and construction process. The latter two approaches to the study require a background in the Navy's facilities business. The first procedure is intended for the reader who is interested in the full details of the study. This reader should start with Section B and read forward. The second procedure is intended for the reader who is interested primarily in an overview, this reader can start with Section C after reading Chapter B1, Research Methodology. Section C is sufficiently cross referenced with the rest of the text that the reader should be able to go into the body of the Thesis on a selective basis, as greater detail is desired.

SECTION A, BACKGROUND

CHAPTER 1, ORGANIZATIONS AND MISSIONS

A1.1 CHAPTER OVERVIEW

In order to understand the Navy's building process it's necessary to identify who each of the organizational players are, and to describe the extent of their involvement in the process.

Starting with the Department of Defense this chapter will move down through the organizational hierarchy, in the Navy's facilities business.

A1.2 DEPARTMENT OF DEFENSE

In terms of direction and control the Department of Defense (DOD) can be thought of as three bodies, the Office of the Secretary of Defense (OSD) which assists the Secretary in carrying out his overall management responsibility, the Joint Chiefs of Staff (JCS) who oversee the Operating Forces and the Military Departments of the Army, Navy (including Naval aviation and the Marine Corps) and the Air Force, which provide and support the Operating Forces. The Joint Chiefs of Staff act as the principal military advisors to the Secretary of Defense as well as the President and the National Security Council. Each member of the JCS, other than the Chairman, is the senior military officer of his respective service and in this sense has a

"second job" as head of his element of the supporting organization, the Departments of the Army, Navy and Air Force.

In carrying out their mission of overseeing the Operating Forces, the JCS prepares strategic and logistic plans to guide their operations. Down the line these plans are translated into specific tasks, many of which require resources such as buildings and other fixed facilities.

The role of the military departments is to provide logistic support, in the way of maintaining, equipping, and training the forces of their respective services, in order to enable these forces to carry out the strategic and logistic plans.

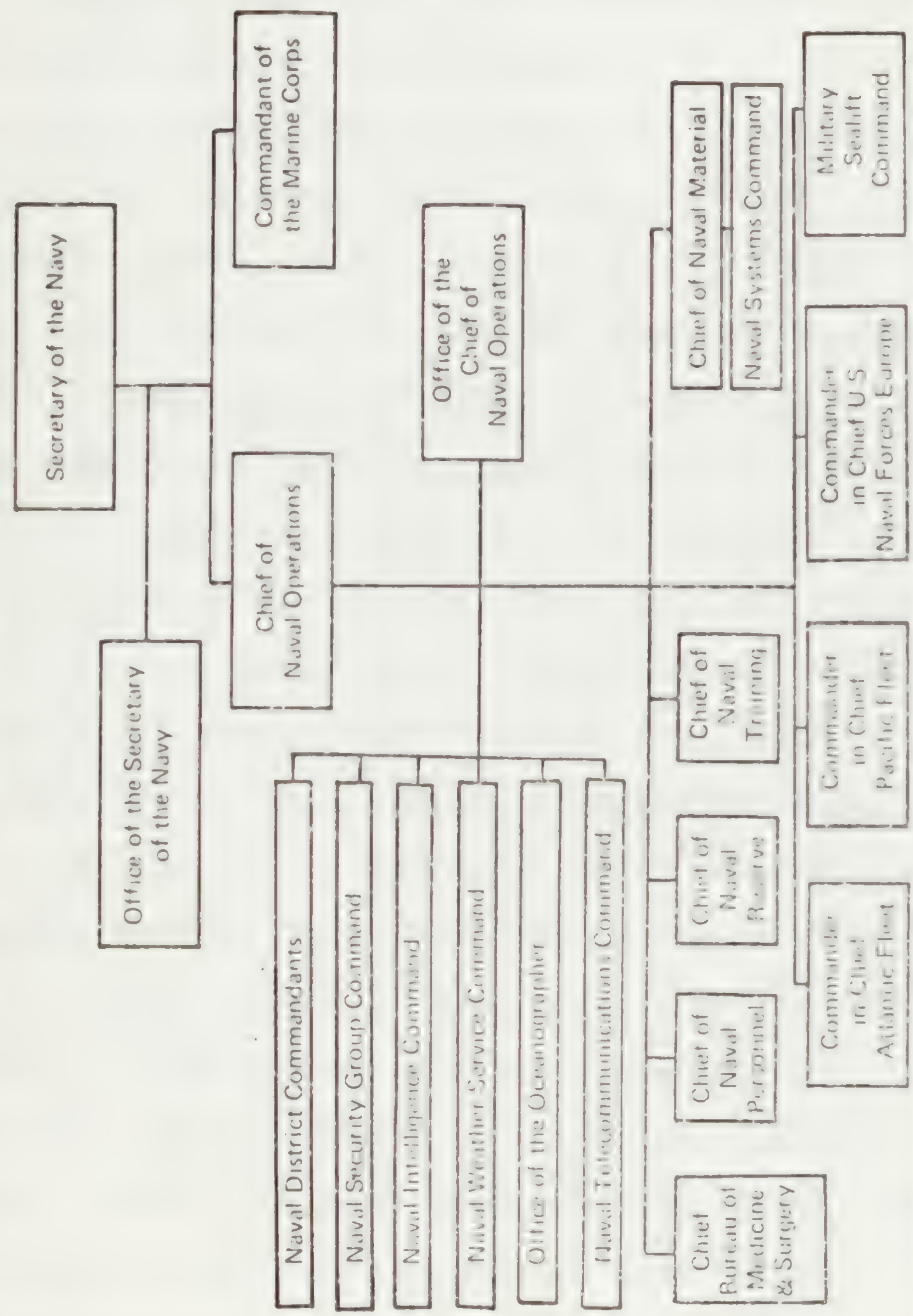
A1.3 DEPARTMENT OF THE NAVY

Functionally, organizationally and geographically the Department of the Navy consists of three parts: The Navy Department, the Shore Establishment, and the Operating Forces of the Navy.

The Navy Department is organizationally comprised of the Office of the Secretary of the Navy, and his immediate staff, the Chief of Naval Operations and the Commandant of the Marine Corps (see Figure 1). Reporting to the Chief of Naval Operations are the Chiefs of what might be referred to as the Navy's

FIGURE 1

DEPARTMENT OF THE NAVY ORGANIZATION



functional commands, and the administrative and support elements of the Fleet Commanders-in-Chiefs and the Commander Military Sealift Command.

The Shore Establishment is comprised of shore activities which have the basic mission of supporting the Operating Forces. A shore activity is a separate unit with a specific mission and the resources, including buildings and other facilities, necessary to carry out this mission. An activity either "owns" its facilities or is a tenant of a host activity, normally referred to as a base or station. There are over 180 host activities which provide landlord services for a much larger number of small "tenant" activities. Each activity reports, usually through intermediate supervisors, to one of the 17 "Major Claimants" who consist of the commands that report directly to the Chief of Naval Operations. These 17 "Major Claimants" are shown in Figure 1. They include all of the subordinate commands that directly report to the Chief of Naval Operations (except the Naval District Commandants), as well as the Commandant of the Marine Corps and the Staff Offices of the Secretary of the Navy. These Major Claimants hold the purse strings within the Navy, and as such are a kind of super customer when considering the building process.

The Operating Forces of the Navy consist of operating units such as ships and aircraft squadrons. They report for operational control to the JCS through Joint and Specified Commands such as the Commander in Chief Pacific.

One of the 17 Major Claimants is the Chief of Navy Material to whom the Commander Naval Facilities Engineering Command reports, along with four other "Systems Commands." These System Commands are responsible for the development, acquisition and support of the Navy's "hardware", which includes weapon systems, and the supplies and facilities the Navy needs to fulfill its mission.

A1.4 NAVAL FACILITIES ENGINEERING COMMAND HEADQUARTERS

In the broadest sense it is the mission of the Naval Facilities Engineering Command (NAVFAC) to provide the Operating Forces of the Navy, facilities engineering support for all fixed land and ocean facilities. NAVFAC's mission can be grouped into four broad categories, planning for activities, acquisition of new facilities, the management of facilities once they are constructed, and the engineering required by contingency plans to maintain military readiness.

(A) The planning portion of the mission consists

of assisting activities (clients) in determining their facilities requirements, programming the correction of facility deficiencies, preparation of the Navy's annual Military Construction Budget, master planning and the management of the Navy's some 4.5 million acres of real estate.

(B) Acquisition consists of the design and construction of new facilities which is the portion of NAVFAC's mission to be discussed in this Thesis.

(C) Facilities management includes the maintenance of facilities once they are constructed, utilities operation, the management and operation of transportation equipment, and the management of the Navy's some 70,000 units of family housing.

(D) The fourth component of the NAVFAC's mission, military readiness, is primarily associated with the support of the Naval Construction Force, the Seabees. The Seabees are part of the Navy's Operating Forces. In addition to supporting the Seabees, military readiness includes the planning, training and the facilities research and development necessary to maintain the capability of providing engineering and related logistics support to the Operating Forces, in the event of contingency operations.

The Naval Facilities Engineering Command Head-

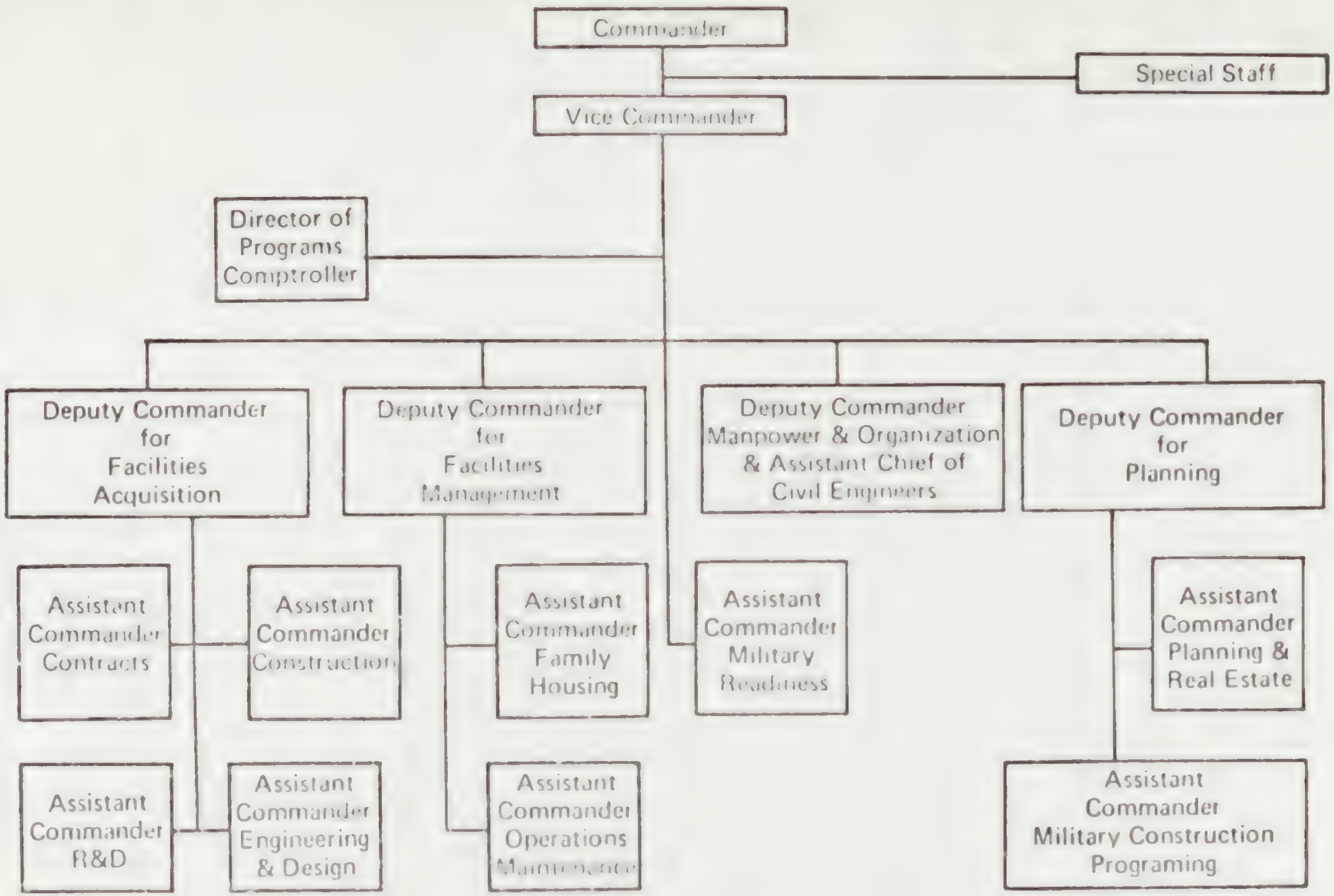
quarters is organized along these same four broad functional categories with a separate Deputy Commander for Facilities Planning, Facilities Management and Facilities Acquisition, along with an Assistant Commander for Military Readiness, who all report directly to the Commander (See figure 2). In addition, a fourth Deputy, the Deputy Commander for Manpower and Organization, reports directly to the Commander in a line capacity. In addition to performing the "staff" type function of heading the personnel and administration departments, the Deputy Commander for Manpower and Organization is the Assistant Chief of Civil Engineers, and as such is largely responsible for carrying out the Commander's responsibilities in his second job, that of the Chief of Civil Engineers.

A1.5 NAVY CIVIL ENGINEER CORPS

Naval Officers are either line officers or staff officers belonging to one of the eight staff corps. The "line" as the name indicates generally provides the operators, and the "staff" are generally support personnel. The Navy's staff corps do not normally show up on an organization chart as these staff corps do not comprise a unit or organizational element with a specified mission. Rather each staff corps is comprised of a group of personnel with specific technical capa-

FIGURE 2

HEADQUARTERS NAVAL FACILITIES ENGINEERING COMMAND
ORGANIZATION CHART



bilities. These staff personnel fill jobs in the Navy Department, the Shore Establishment and Operating Forces which require their specific expertise. Civil Engineer Corps Officers (CEC), most of which are graduate engineers or architects, are involved on all sides of the facilities business. Not only do they man the key positions in the Naval Facilities Engineering Command main and field offices and in the Seabees, but CEC officers serve on the staffs of the Major and sub-claimants as well as serving on the facilities oriented staff components of the Secretaries of Defense and Navy and the Chief of Naval Operations. In addition, most all activities that own facilities, that is host activities, have CEC officers assigned to man the key positions in their Public Works Department. In a normal career a CEC officer will have worked in each of the major types of facility jobs, and in several, at different levels.

The Civil Engineer Corps has an approximate strength of 1400 officers with approximately 12 percent assigned to the Navy Department, 16 percent assigned to the Operating Forces and the remaining 72 percent assigned to the various elements of the Shore Establishment.

It is the job of the Chief of Civil Engineers as the senior CEC officer to advise the Chief of Naval Operations

and the Chief of Personnel on training and personnel development matters concerning Civil Engineer Corps Officers.

A1.6 NAVAL FACILITIES ENGINEERING COMMAND FIELD ACTIVITIES.

The four aspects of NAVFAC's mission are executed through a field organization. The first three elements of the mission, planning, acquisition and management, are carried out by six Engineering Field Divisions (EFD), each of which is assigned a specific geographical area. The fourth aspect of NAVFAC's mission, military readiness, is carried out by two Construction Battalion Centers, one located in Port Hueneme, California, and the other located in Gulfport, Mississippi. Figure 3 shows the major field activities of the Naval Facilities Engineering Command.

Four of the six Engineering Field Divisions, the Northern, Southern, Western and Chesapeake Divisions, (see Figure 4) are responsible for the Continental United States (CONUS) (the Western Division is also responsible for Alaska). The fifth, the Pacific Division, is located in Pearl Harbor, Hawaii and is responsible for the Pacific basin, Asia and the Indian Ocean. The sixth EFD, the Atlantic Division, is responsible for the Mediterranean and Atlantic areas.

FIGURE 3

NAVAL FACILITIES ENGINEERING COMMAND FIELD ACTIVITIES

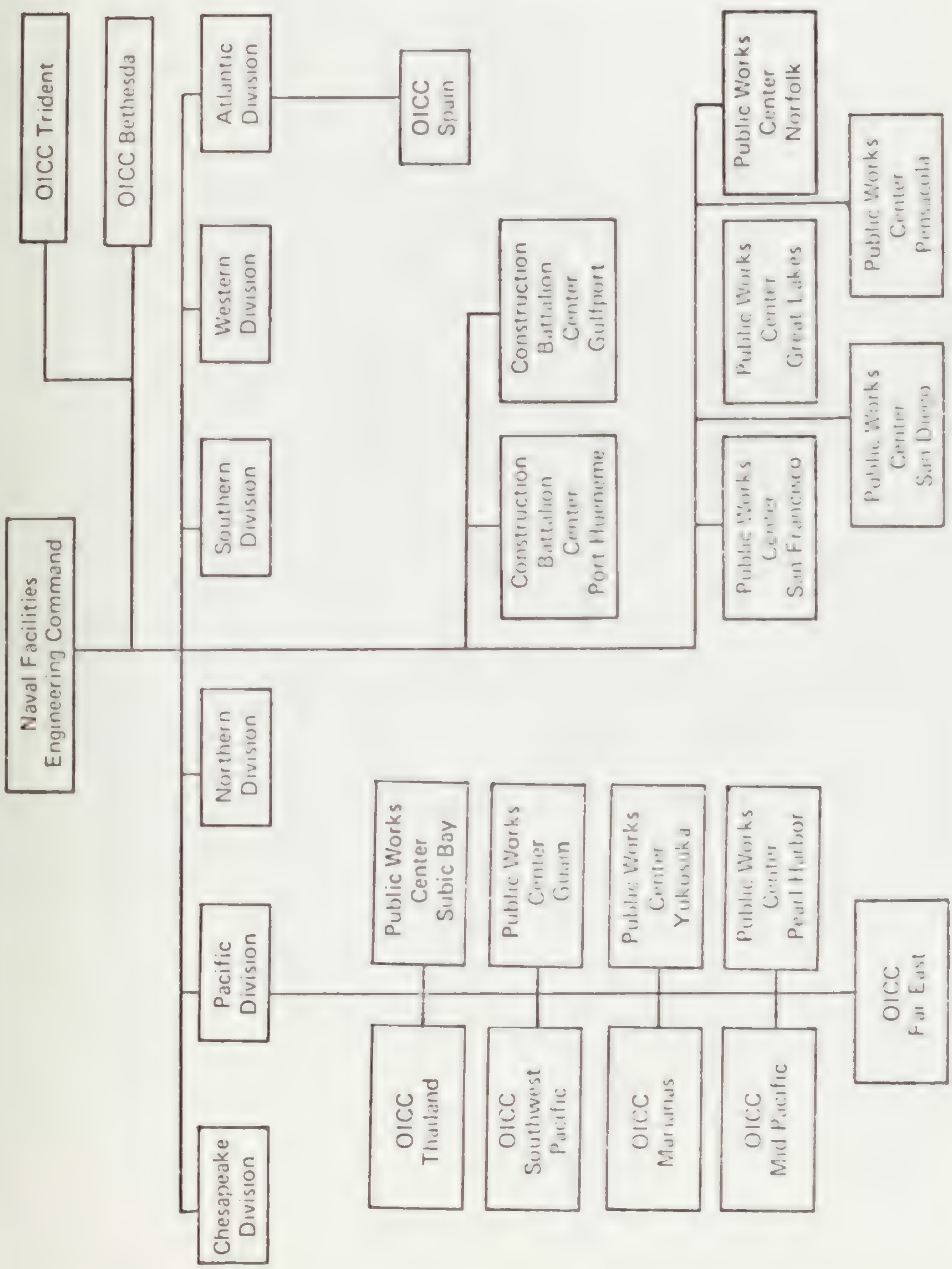
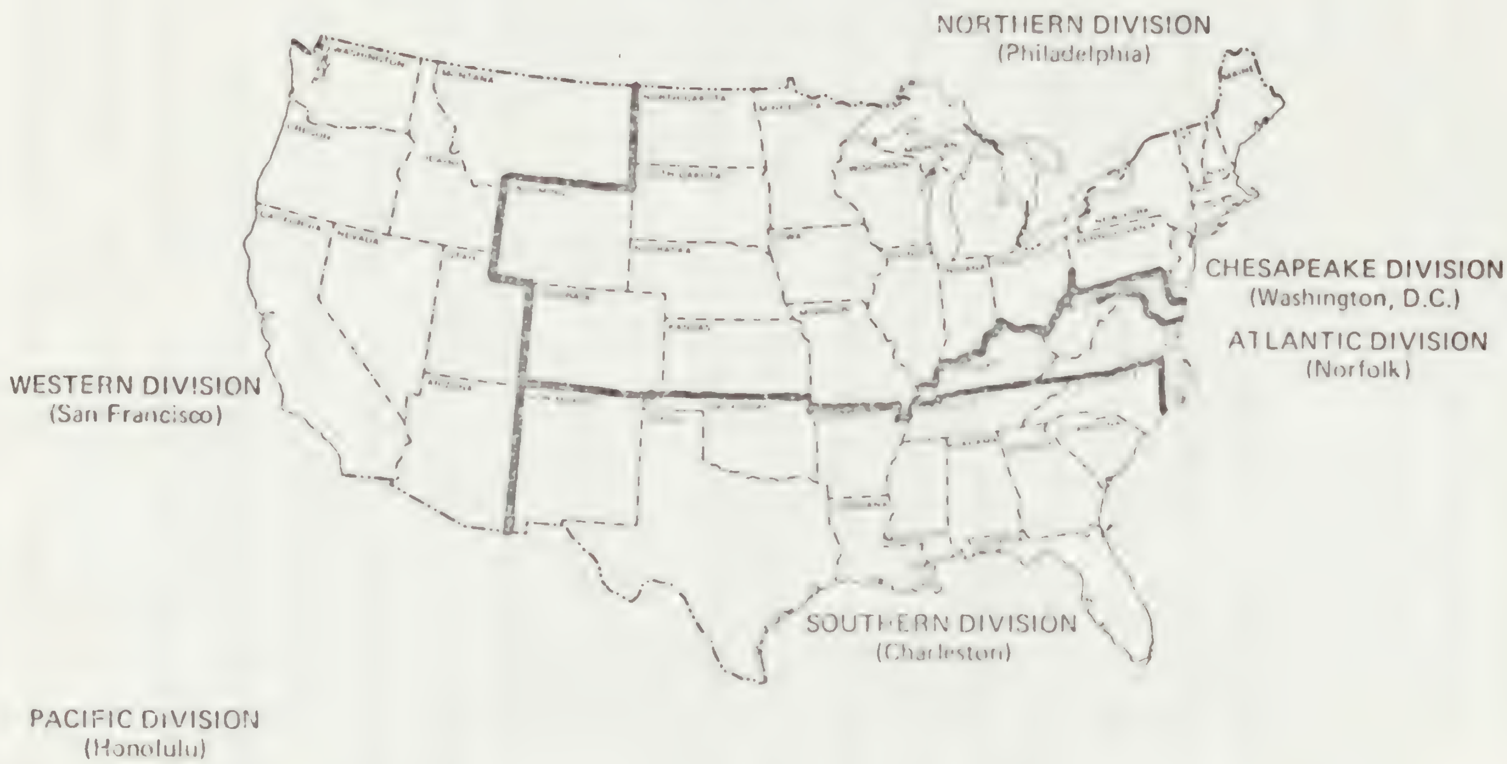


FIGURE 4

ENGINEERING FIELD DIVISIONS
GEOGRAPHICAL DIVISION OF THE CONTINENTAL UNITED STATES



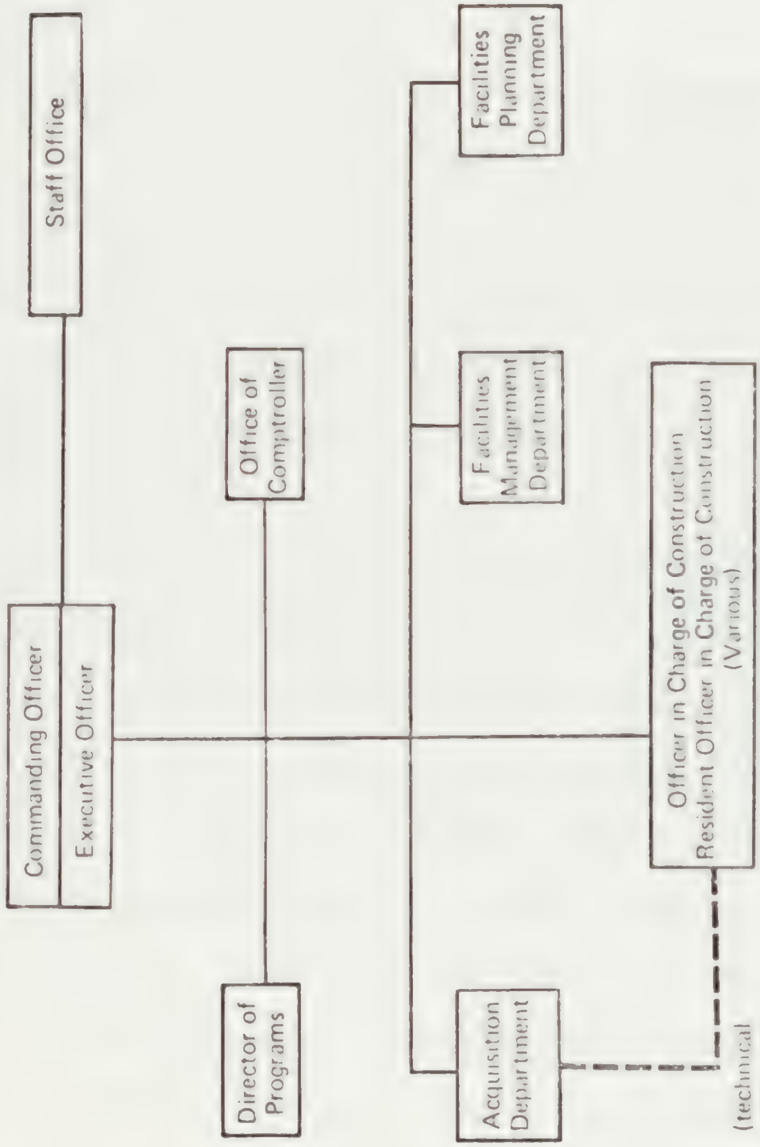
and for South America and Africa. In addition, the Atlantic Division is responsible for the states of Kentucky, West Virginia, Virginia and part of the state of North Carolina.

The EFD organizations are similar to the NAVFAC Headquarters organization. They differ in that they have no counterpart for the military readiness and their manpower and organizational responsibilities are conducted by the Comptroller's Office. Although each of the EFD's have been assigned specific tasks which make them slightly different they are all primarily responsible for carrying out NAVFAC's facilities planning, acquisition and management functions. Figure 5 depicts the standard EFD organization.

Because of the wide geographical dispersion of the activities served by the Atlantic and Pacific EFDs and the additional complexity of doing business overseas, these two EFDs are organized differently than the EFDs that conduct their business within the Continental United States. The Pacific Division accomplishes its acquisition responsibilities through five Officer in Charge of Construction (OICC) Organizations and the Atlantic Division carries out all of its acquisition responsibilities in Europe through one OICC. These OICCs carry out the project management, design and

FIGURE 5

TYPICAL ENGINEERING FIELD DIVISION ORGANIZATION



construction administration functions for each of the activities within their respective geographical areas, where the other four EFDs do most of the design and project management at the EFD and perform construction contract administration at various Resident Officer in Charge of Construction (ROICC) offices located at or near the construction site. Because of the differences in the way business is conducted in the Atlantic and Pacific Divisions this Thesis will concentrate on the four EFDs which do their business within the Continental United States.

Facilities management is implemented by individual activity Public Works Departments to whom the EFD provides technical guidance or through nine Public Works Centers (PWC) which are located in areas where there are concentrations of Naval activities. These Public Works Centers are separate activities and operate like a non-profit business. Although the PWCs receive guidance from the EFD within whose geographical area they are located the CONUS PWCs report directly to NAVFAC.

To handle high priority or specialized acquisition projects of a large scale, which require special management attention, NAVFAC utilizes a project manager approach, and establishes a separate OICC organization

to oversee the project on a "cradle to bed" basis. NAVFAC currently has two such organizations, OICC Trident and the OICC Bethesda. Both report directly to the Commander, Naval Facilities Engineering Command. The OICC Trident was established to provide the planning, programming, design and construction of approximately $500 million dollars worth of facilities to support the nuclear-powered ballistic missile submarines for the Trident Missile System. The OICC Bethesda was established to perform the planning, design and construction of the National Medical Center and the Uniformed Services University of Health Sciences, both to be constructed in Bethesda, Maryland.

SECTION A, BACKGROUND

CHAPTER 2 PLANNING, PROGRAMMING AND FUNDING

A2.1 CHAPTER OVERVIEW

This chapter will identify the steps that a military construction project goes through from inception of a need until Congress has authorized and appropriated funds to fulfill that need. The projects in the MILCON program include all new construction over $50,000 except projects qualifying as emergency construction, urgent minor construction, and projects qualifying for financing under contingency authority granted the Secretary of Defense.

Additionally this chapter will identify the primary sources of funding for new construction projects under $50,000 and the source of funding for alteration and repair type projects.

A2.2 SHORE INSTALLATION AND FACILITIES PLANNING AND PROGRAMMING SYSTEM

The Naval Shore Installations and Facilities Planning and Programming System (SIFPPS) is a system for determining the Navy shore facility needs, the programming of the accomplishment of required new facilities and the disposal of excess facilities. Each year a number of plans are published based on guidance from the JCS, which define the mid and long range

missions and responsibilities of the various elements of the shore establishment. Based on this planning guidance each activity determines the logistic support requirements (LSR) it will need to fulfill its assigned responsibilities.

As an activity perceives a change in its mission it prepares a revised LSR document which states the projected workload of an activity over the next eight years.

Once revised, the LSR is forwarded up through the activity's chain of command to CNO for approval. As such the LSR assures chain of command recognition and authorization of the tasks and functions an activity intends to perform. The LSR is limited to peacetime planning and programming and is not intended to identify support required for contingency or mobilization plans.

Once approved the workload information taken from the LSR is converted into gross facility requirements by application of planning standards and criteria. A Basic Facilities Requirements List (BFRL) is prepared by the activity (of which there are several hundred) with the technical assistance of the EFD with responsibility for the geographical area. Once prepared or

revised it lists all the activity's facility requirements. This form is submitted via the EFD for certification of technical adequacy, to NAVFAC, who acting for CNO, reviews and approves the BFRL.

The next step in the SIFPPS is to evaluate existing assets to determine their capability of satisfying the requirements. This engineering evaluation is performed by the EFD. Once completed the assets are weighed against the requirements and a list of deficiencies and excesses are generated. This report includes, besides new construction, the EFD's analysis of the optimum method of overcoming the deficiency including repairs, rehabilitation, leasing, joint-use with other services, and changes in use of existing facilities. The facility deficiencies are converted into specific engineering proposals, with estimated costs, which are called projects. The projects are forwarded via the Chain of Command on a specified form to the Major Claimant who reviews and assigns a priority for accomplishment. The project is then forwarded to NAVFAC who, acting for CNO, maintains the backlog of facility deficiencies as part of the MCON program objectives, data bank. A similar procedure is utilized to report excess land and facilities.

The use of SIFPPS, as described, is the responsibility of the activity who relies on the EFD for technical assistance. The "activity" usually means the activity's Public Works Department (PWD) which, as previously discussed, is headed by a Civil Engineer Corps Officer, or a Public Works Center (PWC) which serves several activities, and also has its key positions staffed with CEC officers. Tenant activities, that is activities who are residing in facilities which are on the plant account of another activity, will normally rely on the host activity PWO to furnish this service, or when they have their own engineering capability, will perform the service themselves.

A2.3 ANNUAL MILITARY CONSTRUCTION PROGRAM

The Military Construction Appropriation is the smallest of all the Navy Appropriations and averages only about 2 percent of the total Navy Budget each year. In spite of its relatively small size, the Military Construction Appropriation is one of the most complex, difficult to manage, and is subject to the closest scrutiny.

Each year programming the correction of the Navy's facilities deficiencies involves the selection of about 300 projects, this is 5 percent of the approximately 6,000 deficiencies listed in the program objectives

data bank. A priority assigned within the system determines on a "first cut" basis which projects will be included in the current program.

This first cut is the first of four iterations the program goes through in order to establish a realistic program. Each of the iterations are forwarded to the sponsoring Major Claimant who has the opportunity to adjust his priorities for each project.

A2.3.1 <u>NAVY MILITARY CONSTRUCTION REVIEW BOARD</u>

The program is then submitted to the Navy Military Construction Review Board (NMCRB), which consists of representatives from each Major Claimant that has a significant MCON program.

Essentially, the NMCRB reviews each year's program with the Major Claimants being offered the opportunity to defend and justify, or to make changes in the projects which make up their allocation of the program. The board deliberates, arrives at an integrated priority list of projects within the funding levels established and submits the total program to the CNO for approval.

A2.3.2 <u>DESIGN AUTHORIZATION</u>

After the NMCRB recommendations have been reviewed by the Navy's Comptroller (NAVCOMPT) who is part of

the Secretary of the Navy's Staff, and submitted to the Office of the Secretary of Defense (OSD), the EFDs are authorized to proceed to the 30 percent design stage on the 50 percent of the projects which have the highest priority. (This is a recent change to the system; previously, program cost estimates (PCEs) were authorized at this time. A PCE was essentially a preliminary design and required a submission of a separate report. The current system has eliminated this report allowing design to move directly to the 30 percent stage). This is a first cut review which is followed in a few months by a formal OSD review. After the OSD "first cut" the program is forwarded to Congress for a preliminary, "year ahead" informal review. On completion of the OSD review 30 percent designs will be authorized on the next highest 25 percent of the program and cost certification (similar to, but not as expensive at a PCE), will be authorized on the remainder of the program.

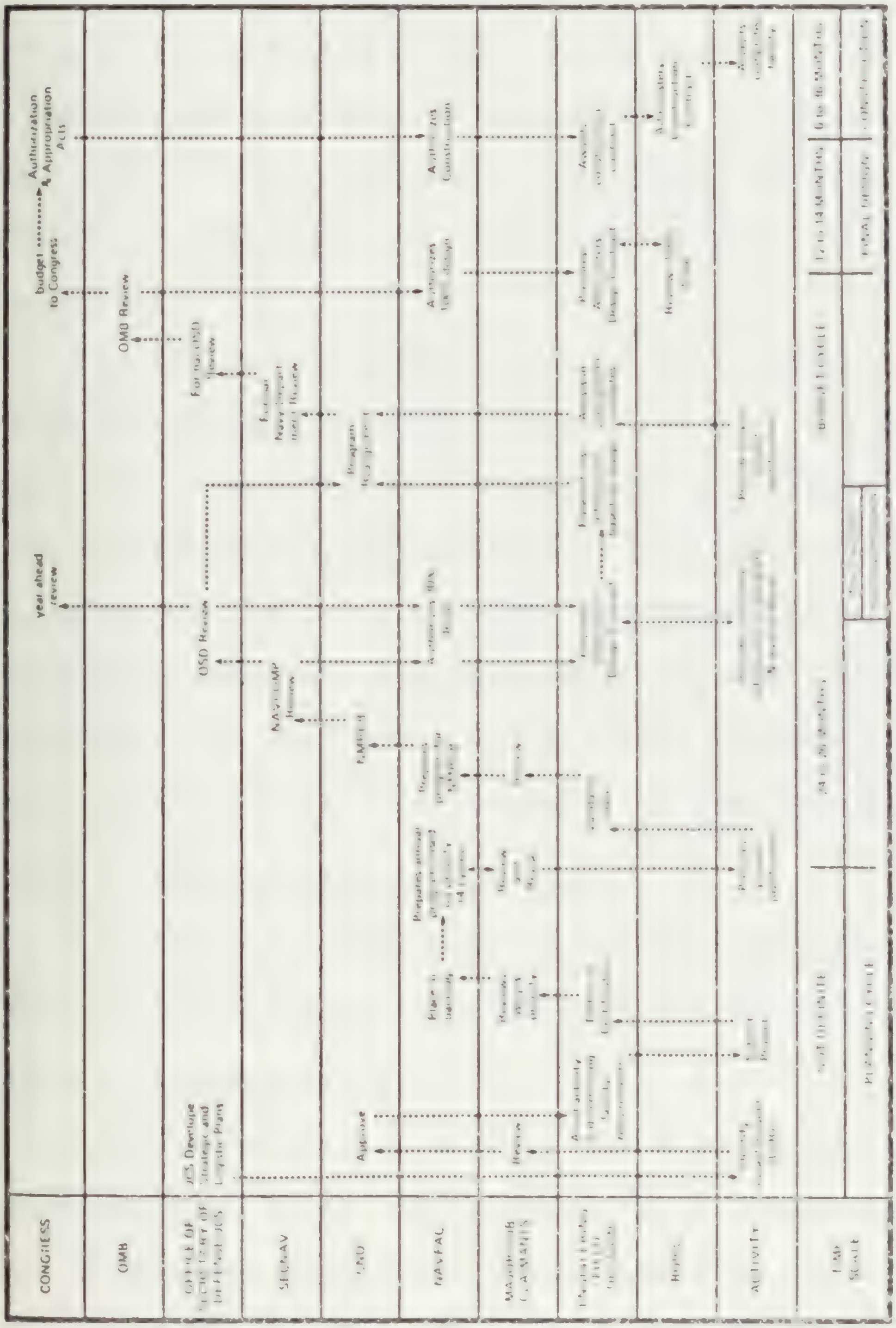
A2.3.3 NAVY DEPARTMENT REVIEW

On completion of the 30 percent designs the pricing data from these designs along with pricing data from the cost certifications are forwarded to CNO through NAVFAC. With the vantage of the more accurate cost data and with the guidance from the first OSD

review, the program undergoes a realignment at the Chief of Naval Operations (CNO) level. At this point the program is again submitted to NAVCOMPT this time for the formal Navy Department review. NAVCOMPT reviews the program in relationship to other programs. Requests for reconsideration are discussed between NAVFAC, the Major Claimant, CNO and NAVCOMPT with all remaining issues being brought to the CNO Advisory Board and ultimately to the CNO for resolution. (Figure 6 shows the complete planning, budgeting and execution cycle for the Military Construction Program).

FIGURE 6

PLANNING, BUDGETING, DESIGN AND CONSTRUCTION CYCLE FOR THE MILITARY CONSTRUCTION PROGRAM



SOURCE: Compiled by author from various documents and discussions with NAVFAC Personnel.

A2.3.4 OSD REVIEW

On completion of the NAVCOMPT review the budget program is submitted to OSD, where another intensive review of each project is conducted. Formal hearings are held with representatives of OPNAV, NAVCOMPT and NAVFAC in attendance to explain and support Navy requirements.

The OSD review culminates in a final SECDEF decision on the program budget level, and with the concurrence of the Office of Management and Budget (OMB) and the President, the individual military construction programs of the three services are consolidated into a unified Department of Defense Military Construction Authorization Bill and a DOD Military Construction Appropriation Bill for submission to the Congress.

A2.3.5 FINAL DESIGN AUTHORIZED

At the point when OSD and OMB have approved the program final design is authorized for all projects.

A2.3.6 AUTHORIZATION

The Authorization Bill is presented before the Appropriation Bill. It is reviewed in detail by the Armed Services Committees of the House of Representatives and the Senate. These reviews are conducted by the Committee's professional staff and through hearings

held by Subcommittees in which the Committee members enter into detailed discussions concerning the validity of the proposed projects and their estimated costs. Each Subcommittee drafts its own report and proposed bill for subsequent approval of the full Committees. Since the House and Senate versions of the Bill usually differ, Conference Committees are convened to resolve the differences. When a compromise position has been reached the revised bill is presented to the House and then the Senate. After being passed by both, and upon the President's signature, the Bill becomes law.

Each annual Department of Defense Military Construction Authorization Act provides authority to construct or acquire certain facilities at designated locations, and establishes the restrictions or limits imposed on that authority. The exact authority provided changes from year to year, but usually includes the authority to construct or acquire new facilities, both unclassified and classified, authority to proceed with emergency construction without further specific congressional approval, and amendments to previous laws for facilities which could not be built within the original authorization. Amounts are specified in the law by location or installation total rather than by

individual project. Unless the Committee reports specifically reduce a project estimate, the amount presented to Congress in the back-up material is considered the "authorized amount" for the project. Some escalation in the amount authorized is permitted. Each Authorization Act includes provisions permitting escalation of the amounts approved for construction at individual installations. The Authorization Act unlike the Appropriation Act always contains a specific provision as to the date upon which the Authorization granted for a project will expire, or be rescinded, if the project has not been started. If it is desired to start a project after that date, legislative release, or a recision waiver, must be obtained on an exception basis.

A2.3.7 APPROPRIATION

The ideal situation would allow the submission of the Appropriation Bill to Congress after the Authorization has been passed. However, in order to permit complete review by the Appropriations Committees, the Appropriation Bill is normally submitted long before the Authorization Bill becomes law on the assumption that the entire authorization requested will be approved. In addition to funds to construct projects in the program, the Appropriation Bill includes funds

for planning and design (the funds used for preparing plans and specifications for future years programs, and certain other engineering support), funds for minor construction which will be discussed later, and funds for access roads (funds provided for the improvement of off-station roads which is made available to the Federal Highway Administration for financing, in whole or in part, access roads certified by the Secretary of Defense as important to national defense). In addition, each funding program may include requirements for funding of projects authorized but not funded in a prior year, or requests for funding of deficiency judgments resulting from court judgments in land acquisition condemnations or other claims. The review hearings, revised bills, and finally the Law proceed in the same manner as the Authorization.

One of the most significant characteristics of the Military Construction Appropriation is that it is continuing. Once a dollar has been appropriated under this appropriation, it is available without time limit until obligated and expended. The Appropriation Law does not list either projects or installations. Rather, it authorizes a certain lump sum amount to be expended from the Treasury, for authorized military

construction projects.

The final Appropriation amount is always something less than the total amount authorized and approved for funding. In most years, Congress approves, for funding, a certain number of projects with a total estimated cost, but then actually appropriates funds in an amount less than that required to complete all the approved projects. This is an additional means that Congress has imposed, to ensure that the services only build what is actually required, and that any excess in the appropriation account from prior years is utilized. The balance in the MILCON bank account is one of the factors Congress reviews to determine the final amount for the Appropriation Act.

The total cost estimate of a project, submitted to the Congress, includes the engineering estimate for the cost of the construction contract made at the completion of the 30 percent design or the cost certification, a contingency for change orders which varies usually from 5 to 10 percent, supervision, inspection and overhead (SIOH) costs which are 6 percent of the estimate of construction costs plus contingencies and a cost escalation factor which varies depending upon the date that the cost estimate was made and the estimated date of the contract award.

A2.4 MINOR CONSTRUCTION ($50,000 - $300,000)

Funds are provided in each Military Construction Appropriation Act for minor construction and are used for projects costing in excess of $50,000 ($25,000 for reserve components) and less than $300,000. In order to qualify a construction project must, because of an existing or developing condition, be so critical that it cannot be delayed for inclusion, in a future MILCON program. Projects for which the requirement should have been foreseen are difficult to justify.

Requests for minor construction far exceed funds available. Only the most critical projects with a truly urgent need get approved. In addition to rigid controls set up by OSD a semi-annual report of all projects approved against this authority is required to be submitted to the Congress.

A2.5 SPECIAL PROJECTS (LESS THAN $50,000)

Funds for all projects of $50,000 or less ($25,000 or less for reserve components) are budgeted in the Operations and Maintenance (O&M) and the Research & Development (RDT&E) Appropriations. Through the O&M and RDT&E budget processes, funds for special projects/ minor construction are assigned by CNO to the Major Claimants for allocation to sub-claimants (an intermediary between the activity and the Major Claimant)

having responsibility for support of shore activities.

Projects included in the special projects category are:

(1) Minor construction projects having a funded cost in excess of $15,000 but not over $50,000 ($5,001 to $25,000 for reserve activities)

(2) Repair projects having a funded cost in excess of $25,000 (over $10,000 for reserves)

(3) Maintenance projects having a funded cost in excess of $25,000 and meeting certain criteria.

(4) Equipment installation projects which meet specific criteria.

(5) Projects which include a combination of the above.

A2.6 LOCAL FUNDING AUTHORITY

Activity Commanding Officers normally have authority for new construction up to $15,000, repair up to $25,000 and unlimited maintenance authority within the Continental United States. Balance of payment regulations place further constraints on activities outside the United States. Although a Commanding Officer has authority to expend funds within these limits he does not have authority to contract for these services.

SECTION A, BACKGROUND

CHAPTER 3 CONTRACT AUTHORITY, DESIGN AND CONSTRUCTION

A3.1 CHAPTER OVERVIEW

The Navy does some in-house design and on rare occasions will do in-house construction. However, the large majority of the design is contracted for with private architect-engineer firms and almost all the construction is performed by private contractors under contract to the Navy.

Responsibility for Navy procurement is vested, by statute, in the Secretary of the Navy. The Secretary has delegated this responsibility to the System Commanders for procurement of supplies and services under their technical cognizances. The Commander NAVFAC is designated as "Contracting Officer" for the procurement of specific facility and transportation related items.

It is the intent of this chapter to identify NAVFAC's organizational elements which exercise this contract authority in executing the Navy's continuing design and construction program.

A3.2 ENGINEERING FIELD DIVISION'S CONTRACT AUTHORITY

The Commander NAVFAC has redelegated to the EFD Commanders or Commanding Officers (because of the additional responsibility concerned with their overseas

assignments the heads of the Pacific and Atlantic EFDs are designated as Commanders) the following authority concerning design and construction:

> "Formally advertise contracts for new construction repair or alteration.
>
> Formally advertised purchase contracts for specialized materials and equipment not available through regular supply channels.
>
> Formally advertised contracts for demolition and removal of buildings and structures.
>
> Negotiated lump-sum architect-engineer (A-E), and Engineering Service (E-S) contracts.
>
> Fixed price "informal" contracts. (less than $2,000)"(1)

Authority for negotiated construction contracts other than A-E and E-S contracts is delegated on a case by case basis.

A3.3 OFFICER IN CHARGE OF CONSTRUCTION AUTHORITY

The Commander/Commanding Officer of the Engineering Field Division also has the authority to re-delegate all or part of his authority to field personnel within his geographical area. Normally he will delegate OICC authority to CEC officers who are assigned as Public Works Officers (PWO) of specific activities, primarily

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1. CONTRACTING MANUAL, NAVFAC p. 68, December 1972, p. 1.4.1.

for the purpose of executing the design and construction of projects funded at the activity level. The OICC authority includes the preparation of the drawings and specifications; the issuing of invitations for bid; the opening of bids; the issuance of notices of award; the execution of contracts, change orders, and other contract instruments; the negotiation of change orders; the selection and fee negotiations for authorized negotiated contracts; and the administration of all these contracts. This authority is specified in the same language as it is delegated to the EFD, except that specific dollar values are assigned for each contract category.

As explained the local OICC assignment is primarily intended for the design and construction of contracts funded at the activity level or by the Major Claimant as a "special projects". Most Public Works Departments have their own Engineering Departments which are capable of performing in-house design as well as administering A-E contracts. Although these Engineering Departments receive technical guidance from the EFD they are part of the activities staff and as such do not come under the direct control of NAVFAC. The PWO/OICCs perform this assignment not only for the activity to which they are assigned but

for all the tenant activities which the station or base may service. Although an OICC may be assigned the administration of a MILCON project, normally the EFD will administer all MILCON projects themselves. The dollar amount of the authorized authority of any OICC will depend on the size of the station workload, the rank/experience of the Public Works Officer and the availability of an area ROICC office. Typical authority for a large station Public Works Officer who is a Captain might be $100,000 for construction and $10,000 to $15,000 for A-E contracts with "one time" authority for higher values granted on an individual basis.

A3.4 RESIDENT OFFICER IN CHARGE OF CONSTRUCTION AUTHORITY

The construction contracts for virtually all MILCON projects, administered by the four CONUS EFDs are administered by a Resident Officer in Charge of Construction (ROICC). The ROICC office is a field unit of the EFD and has the job of administering construction contracts, which the EFD has prepared and awarded. Where a ROICC office is available they will normally also administer all the local OICC's construction contracts. During FY 75, 95.5 percent of the dollar value of the work administered by the

DOWN LOADING

four CONUS EFDs and their OICCs was admir this manner. As stated, the local OICCs accomplish a good portion of their own design using their public works engineering staffs.

Where an activity does not have sufficient resources the EFD will perform the design for them. At the end of the calendar year 1974 the in-house engineering staffs of the public works departments and centers world-wide, amounted to 1641 personnel compared to the 833 personnel in the engineering departments of the six EFDs. Although twice as many engineering personnel are in the PWDs and PWCs a considerable portion of their time is involved with doing engineering for maintenance and repair type projects which are accomplished by civil service personnel. The work performed by activity personnel includes very little new construction or major non-recurring repair as it is NAVFAC's policy to accomplish this work through contract, whenever possible. Although in FY 75 the local OICCs did only about 10 percent of the design for construction contracts in terms of the construction cost they prepared plans and specifications for over twice the number of projects the EFDs prepared plans and specifications for.

As the workload at any given site varies from

year to year so does the size and nature of the ROICC offices. Currently the four EFDs under study have 13 large offices (over 15 million dollars work in place (WIP) per year), 18 medium size offices (between 5 and 15 million WIP per year), and 29 small offices (between 1 and 5 million WIP per year). Generally those stations with less than 1 million WIP per year perform the construction administration function with additional duty personnel, or this function is accomplished directly by the EFD with their own forces or with an A-E inspection contract. The 4.5 percent of the work not accomplished by ROICC offices during FY 75 was accomplished by one of these methods.

Although the ROICC office is an EFD field unit and its personnel are on the EFD's payroll, ROICC offices are frequently co-located with the major public works office in the area. Of the 60 ROICC offices in the four EFDs under study only 7 have full time officers designated as ROICC. The ROICC for the other 53 offices is assigned as an additional duty to an activity public works officer who is normally the ROICC's major customer. In the case of the larger offices which serve several bases or stations the public works officer with the largest department is the one usually assigned the ROICC duty. In several instances the Commanding

Officer of a Public Works Center is ROICC. As a result there is a close relationship between the ROICC office and the public works department or center which is the primary duty of the officer designated as ROICC.

A3.5 AREA OFFICER IN CHARGE OF CONSTRUCTION/RESIDENT OFFICER IN CHARGE OF CONSTRUCTION

Most of the large ROICC offices and many of the medium size offices are area offices, i.e., they serve more than one major activity (base or station). In these cases the OICC authority of the customer activity's public works officer will generally be limited to informal type contracts (under $2,000) and A-E contracts, and the ROICC will be designated as an area OICC, with the responsibility for advertising, awarding and administering all construction contracts over $2,000 within the area. However the customer PWO will still provide the plans and specifications for projects funded by his activity.

A distinction between the OICC, the ROICC and the area OICC/ROICC has been made here because this difference in offices effects the nature of their workload. However, the remainder of the Thesis will refer only to the ROICC office whose personnel in all three cases are the personnel responsible for performing

construction contract administration. Although the effect of the local OICC's contracts on the ROICC office's workload is an important aspect of ROICC operations, the primary interest of the Thesis is the 90 percent of the projects (in terms of construction dollars) whose design is prepared by the EFD.

SECTION B, RESEARCH FINDINGS

CHAPTER 1, RESEARCH METHODOLOGY

B1.1 CHAPTER OVERVIEW

This chapter will state the research hypothesis, describe the development of a survey used as part of the data gathering process, categorize the responses to the survey and will identify the origin of the other statistical data used.

B1.2 HYPOTHESIS

It is the position taken in this Thesis that there is a significant loss of potentially valuable communication between the design and construction phases in the major portion of the Navy's continuing building program. As a result of this gap the personnel responsible for construction administration are only partially benefiting from the design engineer's specific knowledge of each project, and the design engineer is only partially benefiting from the construction administrator's familiarity with local conditions which include his potential for understanding of customer needs due to his close geographical proximity and day to day working relationship with him. The gap between design and construction is due to the geographical and organizational separation of these two

processes and the fact that design and construction are generally managed as separate continuing programs. As a result of this functional, rather than product, orientation and as a result of pressures and specific requirements of the Congress and the DOD the primary focus in the building process is on interim means rather than end product performance.

In addition, resources tend to be allocated strictly on the basis of relative changes in program levels (dollar) and not on the basis of the specific requirements of each project. As such, the differences in the unique character of each EFD's workload are not being fully recognized. As a result each EFD's capabilities and commitments to meet the current set of program goals vary.

The EFD organizational element which has the correct title (Project Management) and organizational position to manage the gap between design and construction is not practicing project management in its full context. The fact that the major problems in the acquisition process are managerial not technical, may be largely a result of not managing this gap.

This hypothesis may be more concisely restated as a series of five related hypotheses:

(1) There is a loss of valuable communication between design and construction in the Navy's current building process.

(2) The EFD project manager is not practicing project management in its full context.

(3) Design and construction are currently being functionally managed as separate continuing programs which has contributed to a focus on means rather than end product performance.

(4) The current management system does not directly recognize the unique requirements of each project nor, does it recognize the unique character of each EFD's workload, and as such both the commitment and capability to achieve uniform goals vary.

(5) The major problems faced in the design and construction portions of the building process are managerial not technical.

The hypotheses as stated are a result of an iterative evolution which took place throughout the development of the Thesis. The initial hypothesis, that there is a loss in continuity between the design and construction processes in the Navy's continuing building program, has remained unchanged. However, the understanding of the specific nature of the gap, and the problems related to it, evolved as the

investigation proceeded. The hypotheses as finally stated, express the understanding of the problem as seen from the perspective of the study described herein.

Although it is certainly implied here and throughout the Thesis, that the loss in continuity between design and construction has a detrimental effect on the performance characteristics of the end project, this allegation would be very difficult to prove and is therefore not stated as part of the hypothesis nor will there be any attempt to do more than suggest that the relative performance indicators discussed, reflect significant differences in the performance of the end product.

It is the intent of the Thesis to substantiate the hypotheses, as far as possible, and to set forth realistic recommendations that have proven successful in similar settings.

B1.3 SCOPE OF THE INVESTIGATION

Because of the differences in the way business is conducted outside of the Continental United States (CONUS) (see sub-chapter A1.6) this investigation has been limited to the four Engineering Field Divisions who conduct their business inside the CONUS. These EFDs are the Northern, Southern, Western and Chesapeake Divisions. As can be seen from Figure 4 the Atlantic

Division, in addition to its other geographical responsibilities, is responsible for the states of Virginia, West Virginia, Kentucky and part of North Carolina. This part of the United States will therefore not be covered in the study, nor will the work performed by the OICC Trident and the OICC Bethesda be covered (see sub-chapter A1.6). The only other exception to the above is that the workload of the ROICC Adak, Alaska is included in the Western Division's workload. However, this is very small. As can be see from Figure 7 the workload of the CONUS EFDs accounted for about two thirds of the NAVFAC total in FY 75, and is projected to remain about in the same proportion through FY 78.

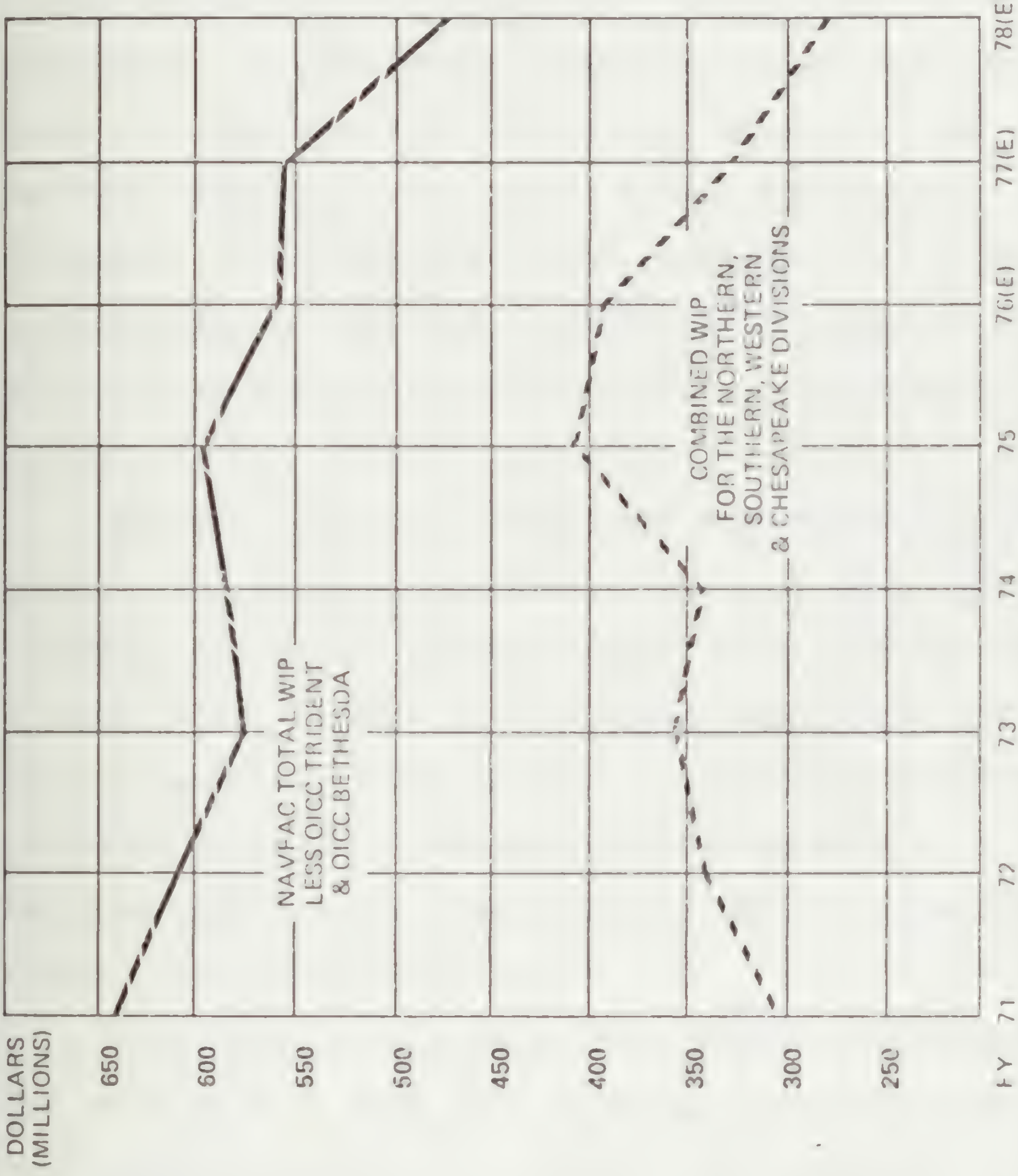
B1.4 DATA COLLECTION

B1.4.1 APPROACH

There were two tasks that had to be accomplished during the data collection portion of the Thesis development. The first, was to substantiate the existence of the loss in continuity and to quantify the contentions stated with respect to it. The second and more difficult task was to evaluate all aspects of the current organization to determine what organizational changes were feasible and to determine what aspects of the current organization if any, supported change.

FIGURE 7

A COMPARISON OF THE HISTORICAL AND PROJECTED WORK IN PLACE (WIP)
IN CONSTANT FY 71 DOLLARS
FOR THE FOUR EFDs UNDER STUDY WITH THE TOTAL FOR NAVFAC



SOURCE: Historical WIP figures provided by Program IV Coordination Office NAVFAC. Projected figures developed using MCON Data Bank and factors for other fund sources obtained from the Program IV Coordination Office. Constant dollars, historical, based on Engineering News Record's Building Cost Index. Projected constant dollars based on most recent OSD guidance on pricing and escalation available in August 1975.

As both tasks were interrelated they were not approached separately nor will the results of the research be presented separately in the Research Findings Section of the Thesis. However, each of the hypotheses will be dealt with separately in Chapter C1, Summary of the Research Findings. Chapter C2, A Case for Project Management, which delineates the conclusion and central recommendation of the Thesis, will build on the evaluation of the current organization presented in Chapters B2 through B4.

The data gathering process was approached in four phases. The first was an indepth analysis of the Navy's planning, design and construction process with the intent of describing who does what to whom, when, where and why. This phase of the study as well as the second phase was conducted during two 3-week visits to the Navy's building headquarters, the Naval Facilities Engineering Command, Alexandria, Virginia.

The second phase involved an analysis of historical and projected, staffing and workload statistics with the intent of putting the various organizational elements that conduct the Navy's building process in perspective and of identifying, as far as possible, their differences and similarities.

The third phase involved sending an indepth

questionnaire to 60 ROICC offices and conducting eight telephone interviews. This phase was intended to quantify the effect of the alleged discontinuity between design and construction as well as to document various aspects of the current organization.

The fourth phase involved a brief research of the literature in the areas of management by objectives (which is the overall management system utilized by NAVFAC) and project management.

The results of the first phase of the research was presented in Section A, Background. The results of the second two phases of the research will be presented in this section. The results of the fourth phase will be presented in this section, and as supporting evidence to the conclusions presented in the last section.

B1.4.2 <u>STAFFING AND WORKLOAD STATISTICS</u>

Almost all of the statistics used to analyze the personnel and workload trends of the four EFDs and their ROICC offices were taken from the manpower listings which are submitted at the end of each calendar year by each EFD, and from the Construction Management System (CMS), an automated data system which draws on NAVFAC's integrated data base. The manpower listings give both ceiling allowances and on board personnel

strengths. In all cases the figures for on board personnel strength were used. Frequently construction work in place (WIP) figures are compared with personnel figures. The WIP figures are, in all cases for fiscal years which end on 30 June. For consistancy the personnel figures which are the personnel strength at the midpoint in the fiscal year, are represented as the personnel strength for the fiscal year.

Although the questionnaire requested that ROICCs provide WIP figures, and the number of active contracts their offices administered during FY 75, the ROICCs were only asked to provide their "best estimates". Because more accurate and consistent figures from the CMS were available they were used for the workload and manpower comparisons, which allowed a comparison of all 60 ROICC offices where if the survey figures were used, only the 73 percent of the offices who responded to the questionnaire could be compared.

Construction work in place (WIP) is estimated monthly for each project by the ROICC. WIP figures will be presented in the Thesis in several different ways. In some instances this will be done to make a specific point, in other cases because these were the only figures available. As explained in Chapter A3 there are several fund sources for construction projects, each of which have different requirements associated with their use. As such WIP figures appear in management reports sorted in a number of different ways. The WIP figures presented in the Thesis are defined below:

TOTAL WIP - This designation will be used to represent all fund sources.

MILCON WIP - This abbreviation refers to all Military Construction Appropriations, assigned to NAVFAC for project execution. This accounts for about 75 percent of the total, and includes military construction projects for other services

MCON WIP This abbreviation refers to the Military Construction Navy Appropriation only, and as such is included in the MILCON figure. MCON accounts for about 53 percent of the total.

OMN WIP - This abbreviation refers to the Operation and Maintenance Navy Appropriations. This is the fund source for most of the small projects that are funded by local activities. This accounts for about 15 percent of the total and is not included in the MILCON figure. Although most OMN funded projects are designed and awarded by the local OICC, the EFDs design and award a number of

the large OMN contracts.

Although there is an additional 10 percent of the total WIP in an "other" category, that is not included in MILCON or OMN, this "other" category will be discussed separately. In a number of instances WIP figures are presented in FY 71 constant dollars. The figures from FY 71 through FY 75 are based on the Engineering News Record Building Cost Index. Where projected figures are presented in constant dollars they are based on a 9 October 1974 OSD instruction on pricing and treatment of escalation which was the most recent guidance available at the time the figures were prepared.

B1.4.3 QUESTIONNAIRE

On 1 July 1975 the questionnaire (Appendix A) was sent out to the forty largest ROICC offices in the Northern, Southern, Western and Chesapeake Field Divisions. As the nature of the gap between design and construction had not been fully defined when the questionnaire was prepared, a "shot gun" approach was used, and a wide range of questions were asked. The information requested was divided into the following broad categories:

(1) General information concerning the respondent, the size of his staff, his workload and his success in meeting his contract completion commitments.

(2) Information concerning the ROICC's involvement in design process.

(3) Information concerning the communication channels between the ROICC offices and its EFD.

(4) Information concerning inspection and contract administration procedures.

Most of the information collected will be presented herein. However in order not to burden the Thesis, information which does not directly deal with the discussion at hand will not be presented.

The questionnaire was sent to the 40 largest ROICC offices in the four EFDs under study, with the cover letter in Appendix B .

The cover letter was designed with the intent of being provocative enough to enlist the effort required to fill out and return the questionnaire. As an additional incentive the offer was made to send all interested respondents a copy of the results. All questionnaires were requested to be returned by 1 August 1975. On 7 August 1975, 22 of the forty questionnaires

had been returned. Considering that the results were to be tabulated by EFD and by size of ROICC office, which would have resulted in a very small sample for several of the categories, it was felt that the response was not adequate enough to perform the desired analysis. As a consequence the letter in Appendix C was sent out to all of the original sample. In addition the questionnaire was sent with the original cover letter, modified only with a new requested return date, to the remaining 20 ROICC offices not included in the first sample. The final response was 44 which accounted for 73 percent of the 60 ROICC offices in the four EFDs under study. As not all ROICCs answered each question and others qualified some of their answers, to the point where they were not comparable, the sample for each question varies.

In most instances the statistics presented are sorted by EFD and size of ROICC office. The offices were divided along the lines of the division made in the Zero Base Study (2) however the total FY 75 WIP reported for several of the offices in the June report of the Construction Management System (CMS) resulted in placing offices in different categories

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2. The Zero Base Corps Structure, NAVFACENGCOM Report, Spring, 1975

than they had been placed in the previous study. In addition a number of offices did not fit other aspects of the Zero Base size category definitions. As a result it was decided to divide the offices on the basis of their FY 75 WIP. The WIP limits for each category were changed slightly from those used in the Zero Base Study in consideration of inflation and in order to group offices so that there would be a minimum variance in the size of their staffs. Large offices were defined as all offices with greater than 15 million WIP, medium sized offices were defined as offices with 5 to 15 million dollars WIP and small offices were defined as offices with 1 to 5 million dollars WIP. The three categories of offices accounted for approximately 95 percent of the FY 75 WIP for the four EFDs under study. Appendices F through H identify the category for each ROICC office.

The following is a break down of the survey responses by EFD and size of ROICC office.

TABLE 1 ROICC QUESTIONNAIRE RESPONSE SORTED BY EFD AND SIZE CATEGORY OF ROICC OFFICES

	Number of Responses	Total in Category	Percent of Total
NORTHERN	12	15	80.0
SOUTHERN	13	16	81.3
WESTERN	13	19	68.4
CHESAPEAKE	6	10	60.0
TOTAL	44	60	73.3
LARGE	11	13	84.6
MEDIUM	13	18	81.3
SMALL	20	29	69.0

SOURCE: ROICC Questionnaire

Although most of the questions asked in the ROICC questionnaire ask for the number of projects which fit the situation questioned most of the data presented with relation to ROICC offices is presented in terms of the average percentage of projects for the ROICC offices in the category at hand. The average percentage is the sum of the percent of projects that each ROICC has identified as belonging in a specific category divided by the number of ROICCs responding to the question. The data is presented in this manner because the intent of the Thesis is to describe what ROICC offices are doing not to quantify what percentage of the total projects are being handled in this manner or in that manner. Where the ROICC responses are used to describe attributes of the EFDs Design Divisions, the number of projects in each category will be used instead of the averaged percentage of projects.

B1.4.4 <u>TELEPHONE INTERVIEWS</u>

In addition to the questionnaire telephone interviews were conducted with the four Acquisition Department Heads and the head of their four Project Management Offices. The former interviews were designed to determine how the Acquisition Head used specific elements of his organization and what the major problems were at his level. The latter interviews were designed

to determine project managers' relative involvement in design and construction. Only in the case of the Head of the Project Management Office of the Chesapeake Division was an individual other than the incumbent interviewed. In this case the Acting Head of the office was interviewed as the incumbent was on leave. Appendices D and E list the questions asked in these interviews. Care was taken to ask each question in exactly the same manner.

B1.5 DATA PRESENTATION

The data gathered will be presented in the three subsequent chapters B2 through B4, which with this chapter constitute Section B. The first chapter B2 covers the influence NAVFAC has on the design and construction process. The second chapter, B3, will cover the EFD's involvement in the process and the third, B4, will deal with ROICC offices. As previously stated the evaluation of the current organization and the discussion of the gap between design and construction will be interwoven throughout the presentation of the research findings.

In viewing the figures it should also be noted that the discussions concerning staffing and workload at the ROICC level are dealing with all 60 ROICC

offices where data based on the questionnaire is dealing with 73 percent or less of the total ROICC offices.

SECTION B, RESEARCH FINDINGS

CHAPTER 2, THE NAVAL FACILITIES ENGINEERING COMMAND MANAGEMENT SYSTEM

B2.1 CHAPTER OVERVIEW

This chapter will discuss how NAVFAC's overall management system works in terms of its influence on the EFD's acquisition process. In addition the chapter will discuss three characteristics of the FY 76 goals for the acquisition area. These are; (1) most of the goals are set on a uniform basis for all EFDs and as such they do not take into account the differences between EFDs, (2) congressional requirements and pressures are a major influence on the formulation of goals (3) none of the goals deal directly with the timely completion, cost or quality of the end product.

B2.2 COMMAND MANAGEMENT SYSTEM

B2.2.1 MANAGEMENT BY PROGRAMS

Each of the products and services NAVFAC provides involves a slightly different set of players both within the NAVFAC organization and within the Department of Defense as a whole. Because most of the products and services NAVFAC provides are so interrelated frequently the skills required for a product or service are under the organizational jurisdiction

of two or more functional departments within the NAVFAC headquarters and EFD organizations.

To unify the several skills required in the production of a product or a service NAVFAC has developed nine "programs" which cross the functional organization. These nine programs are:

PROGRAM NUMBER	PROGRAM TITLE
I	RESEARCH
II	PLANNING AND REAL ESTATE
III	ENGINEERING
IV	CONSTRUCTION
V	MILCON PROGRAMMING
VI	SEABEES
VII	(VACANT)
VIII	HOUSING
IX	PUBLIC WORKS
X	ADMINISTRATION

Programs VI, VIII, and X have true "cradle to bed" responsibility for a specific product or service where the other programs cover only a portion of the total life cycle of a product or service. Generally these latter programs consist of grouping of like functions which are handled within the Navy Department and the DOD by the same players. The program

of interest here is Program IV, Construction.

Program VI, includes the design and construction of the yearly Military Construction Program (new construction over 50 thousand dollars) in addition to the design and construction for alteration, repair, and demolition type projects. Program IV is also charged with the administration of all collateral equipment (furniture); but this responsibility will not be discussed here.

The Assistant Commander for Construction (See the NAVFAC functional organization, Figure 2) is the NAVFAC Program Manager for Program IV. The head of the Acquisition Department at each EFD is the Program IV Manager for his geographical area. NAVFAC manages the overall execution of its assigned responsibilities by managing the nine programs. The vehicle NAVFAC uses to promulgate program direction is the Command Management Plan. The plan includes the overall policies applicable to each program, long-range and intermediate objectives to fulfill these policies and explicit performance goals for the current fiscal year.

B2.2.2 COMMAND MANAGEMENT PLAN

The formulation of the annual performance goals and the task of evaluating progress against these goals is the responsibility of the NAVFAC Program

Manager, who is assisted by the program manager at each EFD. "It is the intent of the plan that there be a negotiated contract between headquarters and the EFDs wherein each recognizes his responsibility, the headquarters to properly fund the effort desired and the field to properly execute the assigned tasking".(3)

The plan consists of three sections, the Precepts section which provides an overview of the basic framework within which NAVFAC manages its business, the Objective Plan which contains long range objectives and a mid-range intermediate goals designed to achieve these objectives, and the Operating Plan which describes the specific achievements planned for the current fiscal year. The annual Operating Plan categorizes the goal for each program as product goals, service goals, support goals, improvement goals, and performance goals. The two portions of the annual Operating Plan that contain quantified goals, at least for Program IV, are the product and performance goal sections. Product goals specify a dollar value of construction work in place (WIP) to be achieved by each EFD. The WIP goals are negotiated separately with each EFD, and are the only goals in

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3. FY 1976 COMMAND MANAGEMENT PLAN, NAVFAC P-441.

Program IV which are individually tailored in this manner. Unlike the product goals the performance goals are the same for each EFD. The support and improvement goals are broad in scope and generally difficult to measure.

The following are the FY 76 performance goals which are pertinent to the discussion at hand. The FY 75 goals were similar.

> "Achieve construction project starts for: 30% by 31 March and 80 percent by 30 June, of the total new (current year) programs.
>
> Prepare plans and specifications at a cumulative cost (A-E & in-house) not to exceed 2.5% of the construction cost estimate for conventional design family housing projects, and 5.0% of the authorized amount for MCON projects.
>
> Complete plans and specifications for 50% or more of current FY MCON projects by 31 December and 95% by 30 June.
>
> Complete balance of prior years MCON final plans and specifications by 30 September.
>
> Insure that construction cost estimates are within 5% of the lowest responsible bid.
>
> Keep Change Orders within 3% of the cumulative initial award amount of construction contracts for major MILCON appropriations.
>
> Maintain SIOH (Supervision Inspection and Overhead) expense in Program IV at 3.6% or less of all income bearing construction WIP. (work in place)"(4)

4. FY 76 COMMAND MANAGEMENT PLAN

Each years Annual Plan is first reviewed by the Command Advisory Board (CAB), which is a Command level board that convenes on a regular basis to act both in an advisory and decision making capacity. On completion of the CAB review the plan is forwarded to the Commander for his final approval. Progress against the plan is evaluated at mid-year and year-end in a similar manner.

B2.2.3 FORMAL ROICC APPRAISAL

Although the Command Management Plan provides the EFD with fairly explicit direction, a similar plan is not currently being provided at the ROICC level by the four EFDs under discussion.

NAVFAC places additional requirements, to those in the Command Management Plan, on each of the EFDs through the vehicle of NAVFAC Directives. The EFDs in turn pass the requirements dealing with contract administration in the field, to the ROICC offices through EFD Directives. Requirements placed on the ROICC in this manner include a time limit for processing claims, a time limit to close out contracts after their Beneficial Occupancy Date (BOD), a time limit to process contractors payments and a time limit for the processing of paper work concerning change orders, (particularly when a contractor has been directed to

proceed). Although the EFD normally tracks these administrative requirements, formal evaluations are not held at either the EFD or at the ROICC level. The one item which the EFDs do formally evaluate is safety. The Southern Division, and it is believed that the other three Divisions as well, provide a quarterly safety report which lists the relative ranking of each ROICC office with respect to lost time accidents.

B2.3 GOAL FORMULATION

The Command Management System is based on the principle of "management by objectives" (MBO). One of the basic premises on which this principle is based is, "People support what they help create".[5] Richard Beckhard a highly noted authority in the area of Organizational Development states further:

> "There is evidence that where there is commitment throughout the organization, the goals tend to be higher and the rate of achievement toward them also tends to be higher than where people are asked to respond to goals set from above without having the opportunity to influence them".[6]

5. Richard Beckhard, ORGANIZATION DEVELOPMENT: STRATEGIES AND MODELS, p. 27
6. Ibid, p. 28

Dale D. McConkey a recognized authority on the subject of MBO states in an article, 20 WAYS TO KILL MANAGEMENT BY OBJECTIVES:

> "Tell'em their objectives. Here is the real key to killing MBO: Instead of trusting your subordinate to develop meaningful objectives for themselves, then taking the time and effort to discuss the objectives with them, write the objectives yourself".(7)

> "This technique removes a manager's motivation and commitment to carry out his objectives. As one noted authority in organizational effectiveness suggests, the real value of MBO is participation in the objective setting process, not the objectives themselves".(8)

Rodney H. Brady in his article, MBO GOES TO WORK IN THE PUBLIC SECTOR: stresses this same principle.

> "The establishment of objectives must be a cooperative venture between subordinate and superior. More over, unless both parties feel that the objective is important, challenging and achievable, even cooperative activity will become only a meaningless exercise."(9)

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7. Dale D. McConkey, "20 Ways to Kill Management By Objectives" MANAGEMENT REVIEW, (Oct. 1972) p. 5
8. Ibid, p. 6
9. Rodney H. Brady, "MBO Goes to Work in the Public Section" HARVARD BUSINESS REVIEW, (March-April 1973) pp. 73-74.

These are quotes from just a few authors in this area. An increasing number of behaviorists support the cooperative goal setting process.

As discussed, the performance goals in Program IV are equally applicable to all EFDs regardless of their unique geography, customers and workload characteristics. Although NAVFAC does enter into negotiations with each EFD for the resources necessary to meet the standard goals, evidence will be presented in the two subsequent chapters of this section, which suggests that the staffing levels differed significantly with respect to the workload of each EFD during FY 75. Hence the ability of each EFD to meet the "standard" goals differed. Since all EFDs will not normally reach workload peaks and valleys at the same time, each EFD's ability to meet standard goals would naturally vary from year to year even if they were equally staffed relative to their average workload. The evidence not only suggests that this is the case but also suggests that there are significant differences in the average staffing.

If this is in fact true then the "negotiation" is not achieving an equal level of capability and each EFD's actual progress should be measured separately. However the system does not provide for this flexibility. The FY 76 Command Management Plan states:

"In executing the Command Management Plan each field command develops its own execution plan and has flexability in the application of the resources provided within standard limits. However, no flexability is permitted with respect to the accomplishment of the goals in the Command Management Plan" (10)

B2.4 CONGRESSIONAL INFLUENCE ON THE FORMULATION OF PROGRAM GOALS

The performance goals listed in sub-chapter B2.2 deal with the early award of construction contracts and with keeping the costs of the design and administration processes to a minimum.

The goals dealing with time are based primarily on the objective of obtaining the maximum return for the facility dollar. In light of inflation and the other monetary advantages which are derived from the early fulfillment of an operational need, the Department of Defense is under increasing pressure from Congress to increase obligation rates of military funds. As such the DOD assigns its construction agents obligation targets.

10. FY 76 COMMAND MANAGEMENT PLAN

The importance the DOD placed on this objective can probably be best expressed by the following recent memorandum from the Honorable W. P. Clements, Jr., the Deputy Secretary of Defense, to the Secretary of the Navy, concerning this subject:

> "I am pleased to learn that our construction agents have awarded almost five hundred construction contracts in the past six months with a programmed amount in excess of one and a half billion dollars. This is a significant achievement.
>
> The Naval Facilities Engineering Command's contribution to this record was exceptionally fine with the award of almost $500 million worth of Navy military construction projects including over eighty percent of the line items and over seventy percent of the dollar value of the Navy's FY 1975 Military Construction Program. It is noteworthy that the Naval Facilities Engineering Command took full advantage of a time when the competition for projects in the construction industry was particularly keen. The overall result was that the majority of our contracts were awarded at or below their programmed amounts and provided substantial savings to our construction budget. In addition, the award of these projects during a period of high unemployment in the civilian construction industry was very beneficial to the industry and our nation's economy. During the FY 1975 hearings, we informed Congress that we projected that seventy percent of our FY 75 Military Construction Program would be awarded by August 1975. It is gratifying to see this milestone exceeded at an earlier date than anticipated.

I would appreciate my thanks extended to Rear Admiral A. R. Marschall, Commander, Naval Facilities Engineering Command, and the members of his staff who were directly responsible for this outstanding achievement."(11)

In addition to the pressures to achieve early obligation rates, Congress requires that the design cost be kept within 6 percent of the estimated construction costs (this does not include site investigation or inspection during construction) and that the supervision, inspection and overhead rate (SIOH) be kept within 6 percent of the estimated construction amount. Obviously these Congressional requirements and pressures are a major influence on the formulation of Program IV goals.

B2.5 END PRODUCT PERFORMANCE

B2.5.1 TIMELY COMPLETION

Of significance is the fact that not one of the "performance" goals for FY 76 listed in sub-chapter B2.2 concern the timely completion, the cost or the quality of the end product.

11. "Execution of the Military Construction Program" CEC BIWEEKLY REPORT, 29 July, 1975, p. 1

Although the FY 76 goals do not include a goal for construction completion the FY 75 plan did contain a goal which measured the contract completion date (CCD) against the beneficial occupancy date (BOD). However, the CCD is only a contract tool which does not contain allowances for change orders which on certain types of contracts are inevitable. It is felt that what should be measured is the date the facility is turned over to the customer relative to when it was promised. In many instances timeliness is as, or more, important to the customer than cost or quality, and as such is of at least equal importance with most of the other Programs IV goals.

One of the questions asked in the ROICC questionnaire, for projects completed in FY 75, concerned the percent that were completed on or before the date promised the customer. The following table shows the responses:

TABLE 2 THE AVERAGED PERCENTAGE OF EACH ROICC OFFICE'S PROJECTS THAT WERE COMPLETED ON OR BEFORE THE ORIGINAL ROICC PROMISED BENEFICIAL OCCUPANCY DATE, DURING FY 75

NORTHERN	38
SOUTHERN	34
WESTERN	32
CHESAPEAKE	15
ALL ROICCs RESPONDING	33
LARGE OFFICE	35
MEDIUM OFFICE	32
SMALL OFFICE	30

SOURCE: ROICC Questionnaire

In order to determine the extent that ROICCs participated in establishing the beneficial occupancy date ROICCs were asked the following questions:

On how many of your active contracts during FY 75 did you provide your customers with an original BOD determined in the following matter?

(1) A BOD which was the same as the contract completion date, whether or not it was qualified.

(2) An estimated BOD, which was not the same as the contract completion date and was based on

your knowledge of the situation including your expectations for change orders and other eventualities.

(3) A firm BOD, which was promised by the EFD, or was otherwise determined by circumstances beyond your control, and without the benefit of your counsel.

(4) A firm BOD, which was promised by the EFD, but one in which your office played a significant role in determining.

The Table 3 displays the responses to this question sorted by EFD and size category of ROICC office.

TABLE 3 BASIS OF ORIGINAL BENEFICIAL OCCUPANCY DATES (BOD) PROVIDED CUSTOMERS DURING FY 75

(figures in averaged percentages of projects for each ROICC office in each category)

	Contract Completion Date used for BOD	ROICC Estimated BOD	BOD Established by EFD without ROICC council	BOD Establish by EFD with ROICC Council
NORTHERN	68	14	8	10
SOUTHERN	77	20	2	1
WESTERN	60	38	2	0
CHESAPEAKE	64	34	1	1
ALL RESPONDING ROICCs	67	26	4	3
LARGE	74	19	3	4
MEDIUM	72	24	3	1
SMALL	56	37	2	5

SOURCE: ROICC Questionnaire

From Tables 2 and 3 it is clear that ROICCs are not meeting the promised BOD on 2/3 of their projects and that in 2/3 of the projects the promised BOD was simply the CCD. (Some ROICCs may have estimated that the project would be complete on or before the CCD rather than just accepting the CCD on blind faith.)

Most all the factors that traditionally effect completion dates are known to the ROICC, such as a large amount of underground work, poor record drawings for a particular area, a rushed design, a particular prime or sub-contractor who is usually late in his completions, and difficult to get long lead items, to mention a few. The CCD should, as it is, be set on the basis of a reasonable period of time to complete the contract as specified, without contingencies. Contingencies whether for time and money, or just time, are the rightful province of change orders. The designer is, or should be, in a position to estimate construction time and to establish the CCD. The ROICC is in the best position to make a full assessment of the likelihood of contingencies. In most instances if the designer had been aware of a problem he would have tried to deal with it in the design.

Of equal, if not greater importance to the customer is the date he was given for construction completion at the beginning of design. It is a reasonable assumption that even fewer of these promises are met.

B2.5.2 PROJECT COST

There are three FY 76 goals which deal with project cost. Costs for design are controlled by the goal which states that design cost should not exceed a cumulative cost of 2.5 percent of the construction costs estimated for conventional family housing projects and 5.0 percent of the authorized amount for MCON projects (this is less than the six percent required by Congress). The goal that addresses keeping construction cost estimates within 5 percent of the amount for the lowest responsible bidder controls another element of project cost. A third element of project cost is addressed in the goal which sets the upper limit for change orders at 3 percent of the cumulative cost of the change orders to the initial construction amount. However, there is not a goal which addresses keeping the total project cost within specified limits of the original estimate developed at completion of the 30 percent design and subsequent-

ly submitted to Congress as part of the Military Construction Program.

In addition to fragmenting project costs there is evidence that too tightly constraining the resources available for design may adversely effect the end product.

All of the goals which affect the amount of effort available for design are compared with a derived quality indicator in sub-chapter B3.4.3. This comparison suggests that the quality of design is directly proportional to the total effort expended in producing it, and that high goal achievement reduces the amount of available effort.

With respect to change orders it has been NAVFAC's general policy to treat change orders as undesirable with the belief that changes, even those that are in addition to the original work, almost always cost more than if the additional work were competively bid, and frequently mitigate contractor liability .
Yet for certain situations, such as an extremely tight design schedule were there was not time for the required coordination of the various design disciplines, or situations involving excavation in an area where record drawings were not available, change orders are inevitable.

The following table presents percentages of change order cost to initial contract values for FY 75 projects. The goal for FY 76 was five percent for MCON projects.

TABLE 4 PERCENTAGE OF CHANGE ORDER COSTS TO INITIAL CONTRACT VALUES FY 75

	Percent Change Orders MCON Projects	Percent Change Orders All Fund Sources
NORTHERN	7.7	6.2
SOUTHERN	7.3	6.5
WESTERN	7.6	6.2
CHESAPEAKE	10.2	12.8

SOURCE: CMS Goal Report of 30 June 1975

The tight grouping of the figures for the first three EFDs suggest that it will be very difficult to reduce the cost of change orders to 3 percent of the initial contract value, and further that such a reduction might result in inhibiting necessary changes. As change orders frequently result from time/cost trade-offs, that is a conscious decision to increase the speed of design for a particular benefit knowing it may reduce design quality (a major cause of change orders), change orders should be viewed in the context of the entire project.

B2.5.3 QUALITY PERFORMANCE

Although there are no goals that deal with the quality of the end product the need for a system to measure end product performance (quality) was recognized in the FY 76 plan. The improvement goal which deals with this subject states:

> "Initiate development of a post construction appraisal system which will evaluate the qualitative aspects of facility performance." (12)

John Steward an associate of McKinsey and Company, a large managing consulting firm, states in his article, MAKING PROJECT MANAGEMENT WORK:

> "Quality control experience with a wide variety of projects - new product introduction, merges, plant constructions, introduction of organizational changes, to name a few - indicates that effective quality control of results is a critical dimension of project success. Quality control comprises three elements; defining performance, criteria, expressing the project objective in terms of quality standards, and monitoring progress toward these standards.
>
> The need to define performance criteria through universally acknowledged, is generally ignored in practice." (13)

This implies that the implementation of a meaningful system should involve measuring the end product against performance criteria explicitly spelled out and agreed

12. FY 76 COMMAND MANAGEMENT PLAN
13. J. M. Steward, "Making Project Management Work". BUSINESS HORIZONS, Fall 1975, p. 67

to by all parties, at the beginning of the design. As such the system becomes a management tool to assist in obtaining the required level of performance instead of a measure of the end product which can only show what should have been done.

Performance criteria for a barracks might include total project cost, usable completion date, energy consumption levels for specific lighting, temperature and ventilation criteria, acoustic levels, safety and health criteria and detailed maintenance levels for finishes and systems. Criteria for a "state of art" industrial facility would, of course, be much more detailed. Although NAVFAC currently provides the A-E with general design criteria concerning a number of the aspects of the project, these criteria are normally not explicit in spelling out performance levels, nor is progress uniformly monitored to insure their achievement. Further a post-construction evaluation is almost never performed to determine if the objectives were met, although obvious deficiencies are certainly recognized and corrected.

SECTION B, RESEARCH FINDINGS

CHAPTER 3 THE ENGINEERING FIELD DIVISION

B3.1 CHAPTER OVERVIEW

This chapter will investigate the design and construction processes as they are carried out in the four EFDs under study. A discussion of the general differences and similarities of the four EFDs will be followed by a detailed discussion of the Project Management Office, the Design Division and the Construction Division. The other two offices in the Acquisition Department which will not be discussed in detail are the Acquisition Coordination Office and the Contract Division. The Acquisition Coordination Office acts to assist the Acquisition Department Head in carrying out his overall management responsibilities. Normally this office consists of one CEC officer who will also sit in the Department Head's absence. The second, the Contract Division, performs the extremely valuable service of advertising and awarding contracts, and otherwise insuring that the EFD complies with the legal and contract requirements dictated by higher authority.

In order to put the elements of the Acquisition Department and the ROICC offices (discussion of ROICC offices will follow in Chapter B4) into perspective this chapter will also include a discussion of how the

Acquisition Department Heads view the daily problems in the acquisition process and will attempt to quantify the magnitude of the technical and management problems that are the responsibility of the Design Division and the ROICC.

B3.2 DIFFERENCES AND SIMILARITIES

Of the four EFDs under discussion the Chesapeake Division is the most unique. Geographically its responsibility encompasses the Naval District Washington, D.C. whose borders extend less than 75 miles from its center. This places all of the Chesapeake Division's customers within 1.5 to 2 hours driving time. With a heavy concentration of research activities in the Washington D.C. area their workload includes a larger percentage of sophisticated "state of art" type facilities than any of the other three EFDs. Certainly one of the most significant problems that the Chesapeake Division must contend with is the relatively high government pay levels which exist in the Washington, D.C. area as compared to the other parts of the country. The Chesapeake Division, being a "field activity," has its grade structure set at a level comparable with the other EFDs. This results in their inability to hold qualified personnel and a resulting high turnover. It is under-

stood that this turnover has been as high as 50 percent in a one year period in some Chesapeake Division departments.

With the considerably smaller geographical area and with a fewer number of customers the Chesapeake Division's workload is smaller than the workload of the other three EFDs. Figure 8 shows the historical and projected workload for each of the four EFDs in constant FY 71 dollars.

The operating environment (e.g. geographic size and location, types of projects, and type of customers) of the other three EFDs have some similarities and some differences. (See the geographical division of workload, Figure 4). For example almost all of the area in the Northern Division is subject to problems of severe winter weather where only a small portion of the Southern Division area has this problem. Although each of these three Divisions' geographical areas cover a number of states, by far the majority of their workloads are along the Atlantic, Pacific and Gulf Coasts and the Great Lakes.

Figure 7 shows the historical and projected workload of the four EFD combined plotted against NAVFACs overall workload. The overall total does not include the work to be accomplished by CICC

FIGURE 8

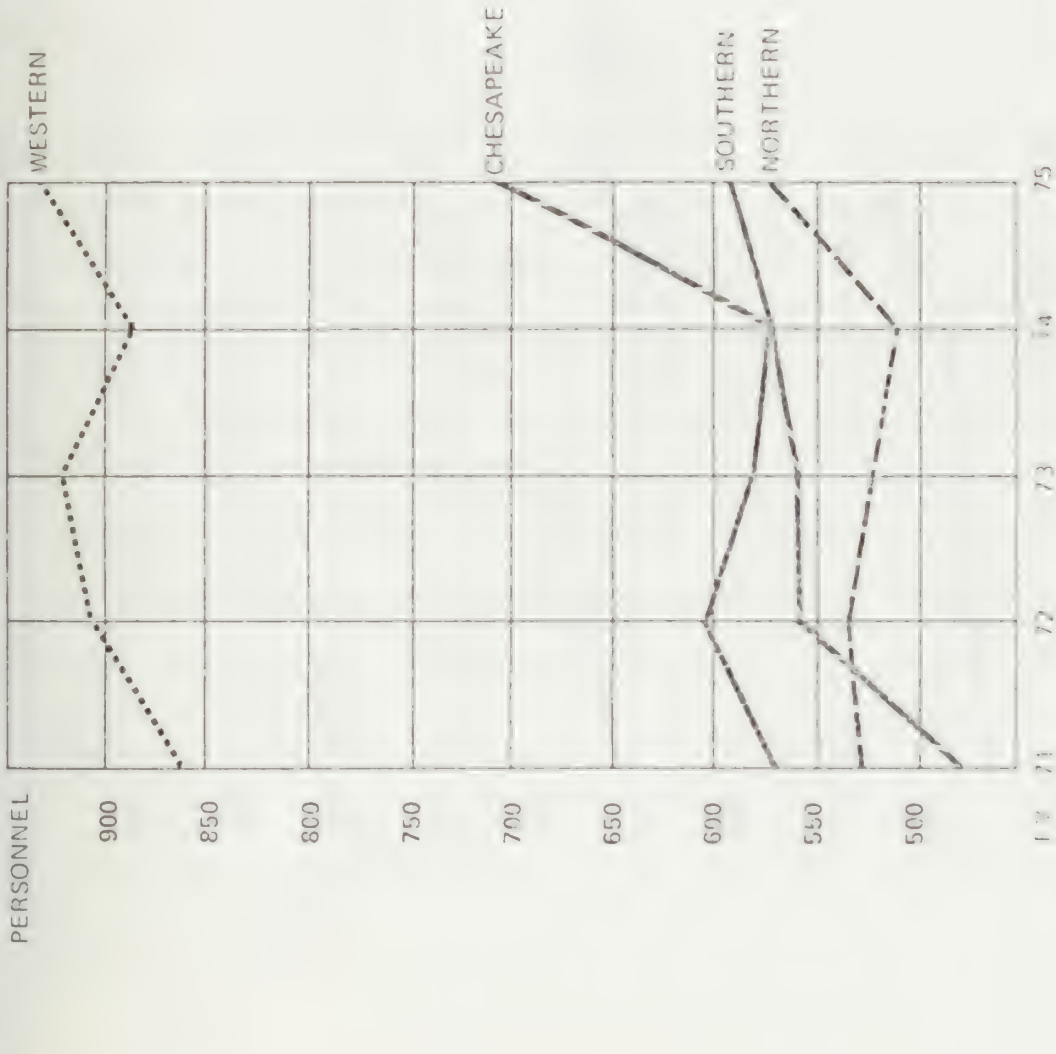
HISTORICAL AND PROJECTED WORK IN PLACE (WIP) IN CONSTANT FY 71 DOLLARS FOR THE FOUR EFDs

SOURCE: Historical WIP figures provided by Program IV Coordination Office NAVFAC. Projected figures developed using MCON Data Bank and factors for other fund sources obtained from the Program IV Coordination Office. Constant dollars, historical, based on Engineering News Record's Building Cost Index. Projected constant dollars based on most recent OSD guidance on pricing and escalation available in August 1975.

Trident and OICC Bethesda as these projects are not typical. Since 1973 the relationship between the NAVFAC total and the four EFDs has held fairly constant with the four EFDs accounting for about two thirds of the total volume of work in place (WIP).

Each of the four EFDs except the Southern Division has incresed their personnel during the last five years, most of which have gone to the Acquisition Departments and ROICC offices. Figure 9 shows the total number number of personnel in the EFDs. Figure 10 shows the number of personnel in the Acquisition Departments including ROICC offices, and Figure 11 shows the percentage of Acquisition Department personnel including ROICC offices, to the total EFD personnel. As the Chesapeake Division has been assigned a number of unique tasks a percentage of their overall personnel strength to the Acquisition Department and ROICC office personnel is not comparable with the other three EFDs and therefore is not shown.

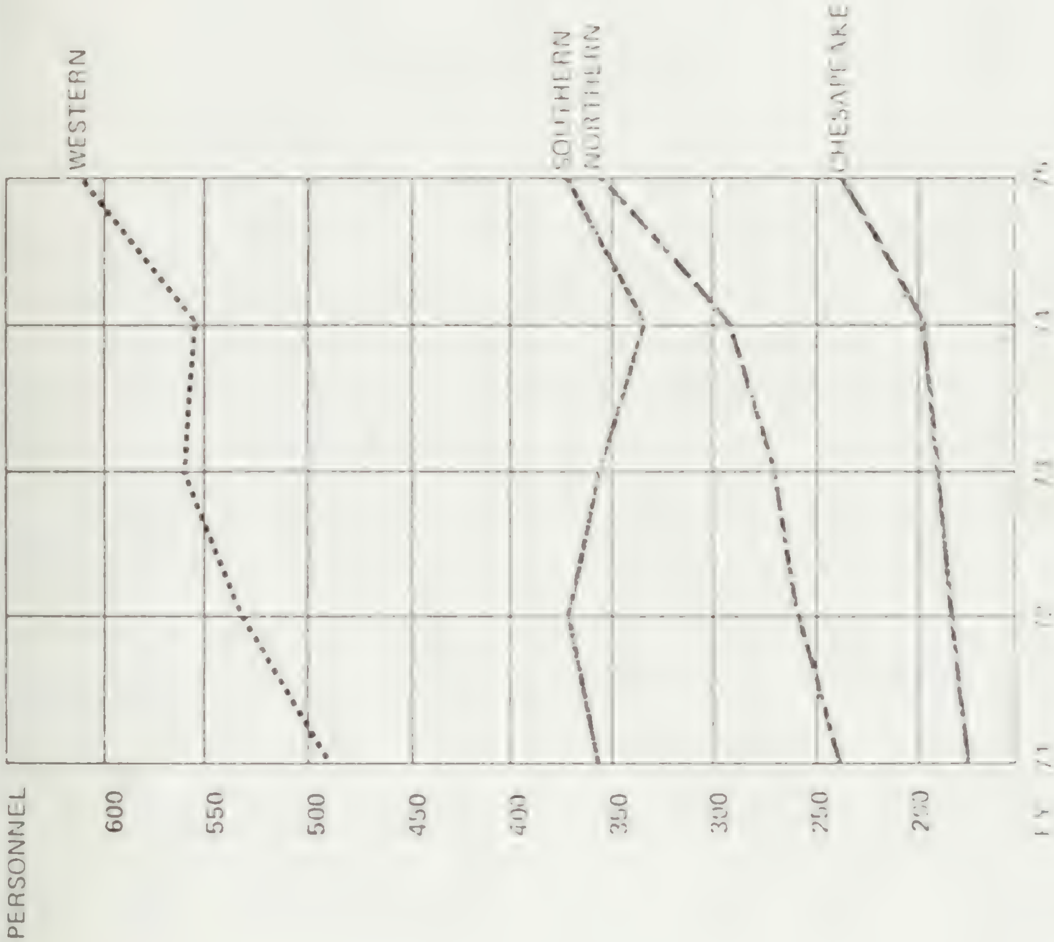
FIGURE 9
TOTAL EFD PERSONNEL FOR THE FOUR EFDs



SOURCE: Manpower Listings, for the years shown, NAVFAC.

FIGURE 10

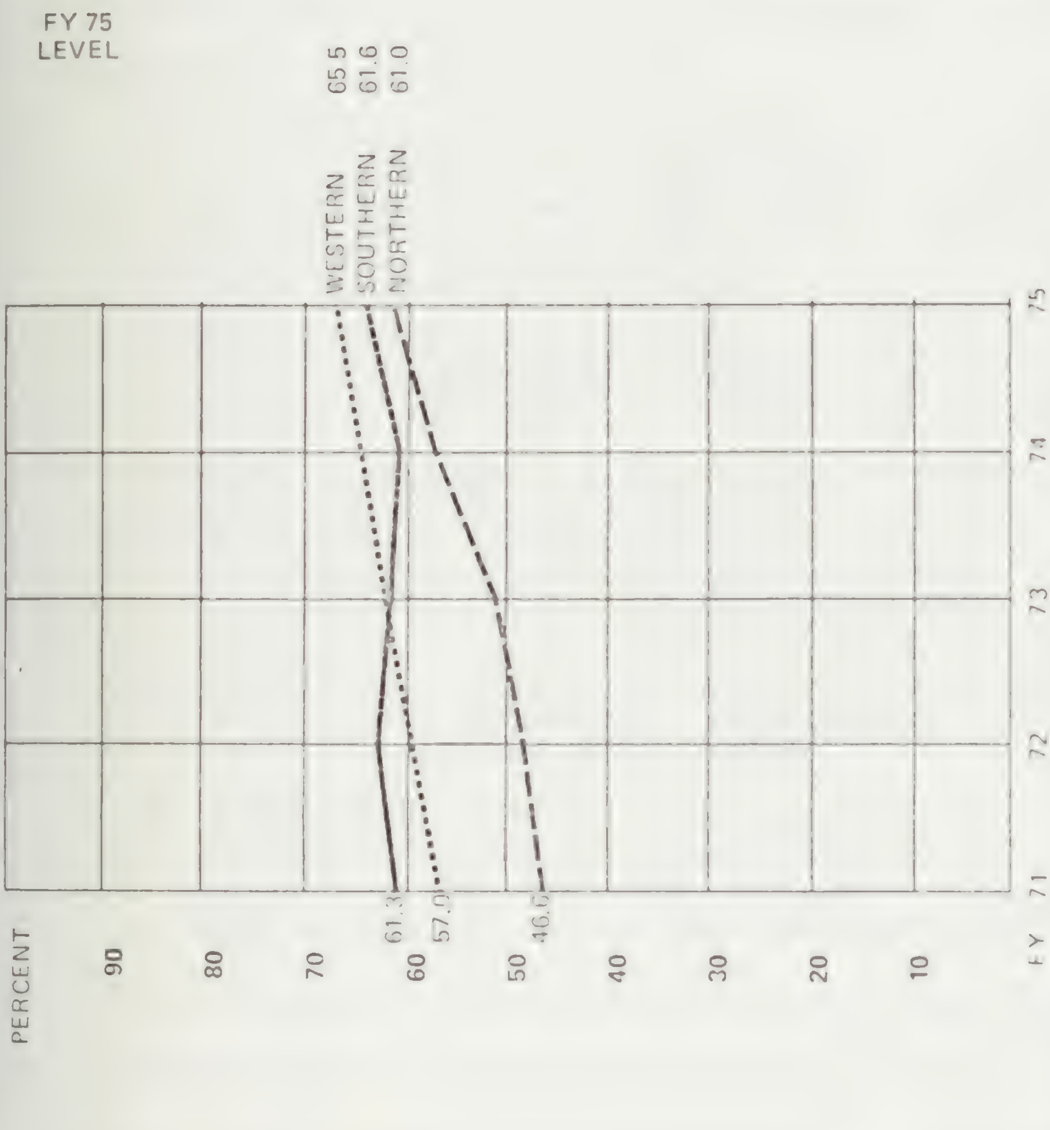
ACQUISITION DEPARTMENT PERSONNEL
INCLUDING ROICC OFFICES



SOURCE: Manpower Listings for the years shown, NAVFAC.

FIGURE 11

PERCENT ACQUISITION DEPARTMENT PERSONNEL
INCLUDING ROICC OFFICES TO TOTAL EFD PERSONNEL



SOURCE: Manpower Listings for the years shown, NAVFAC.

B3.3 ACQUISITION PROJECT MANAGEMENT OFFICE,

B.3.3.1 FUNCTIONS

Among the specific functions that the Acqusition Project Management Office is formally assigned, are the following:

> "Coordinate, review, and monitor contract, design and construction matters for the Head, Acquisition Department, as they relate to specific line item projects.
>
> Review proposed field changes to assure they are within assigned authority and funds.
>
> Serve as the EFD point of contact with NAVFACENGCOM for design, construction, and contractual matters pertaining to (specific) projects.
>
> Initiate and conduct A&E slate (preliminary screening), selections and subsequent fee negotiations.
>
> Establish priorities of in-house contract, design, and construction efforts within guidance provided by the Head of Acquisition Department."(14)

It is significant to note that none of these tasks require that the Project Management Office provide continuity between design and construction or that they serve as a focal point for customers.

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14. WESTNAVFACENGCOMINST 5450.1A Jan. 1973. (Other EFD's functional statements contain identical or nearly identical language).

Figure 12 shows the percent of personnel in the Project Management Office to the total Acquisition Department including ROICC offices, for the last five years. As can be seen, all EFDs have close to the same percentage of their personnel devoted to this function. However, their workload and the relative weight they place on their tasks vary.

Each of the four Project Management Offices, perform the above functions through two or more teams, each with a team leader who supervises two to four Project Managers. The only exception is that the Western Division has a separate branch to handle A-E slate (preliminary screening) and selection procedures, where the Project Managers in the three other EFDs handle these functions. The work in the Project Management Office is split on the basis of customers, fund source and geography.

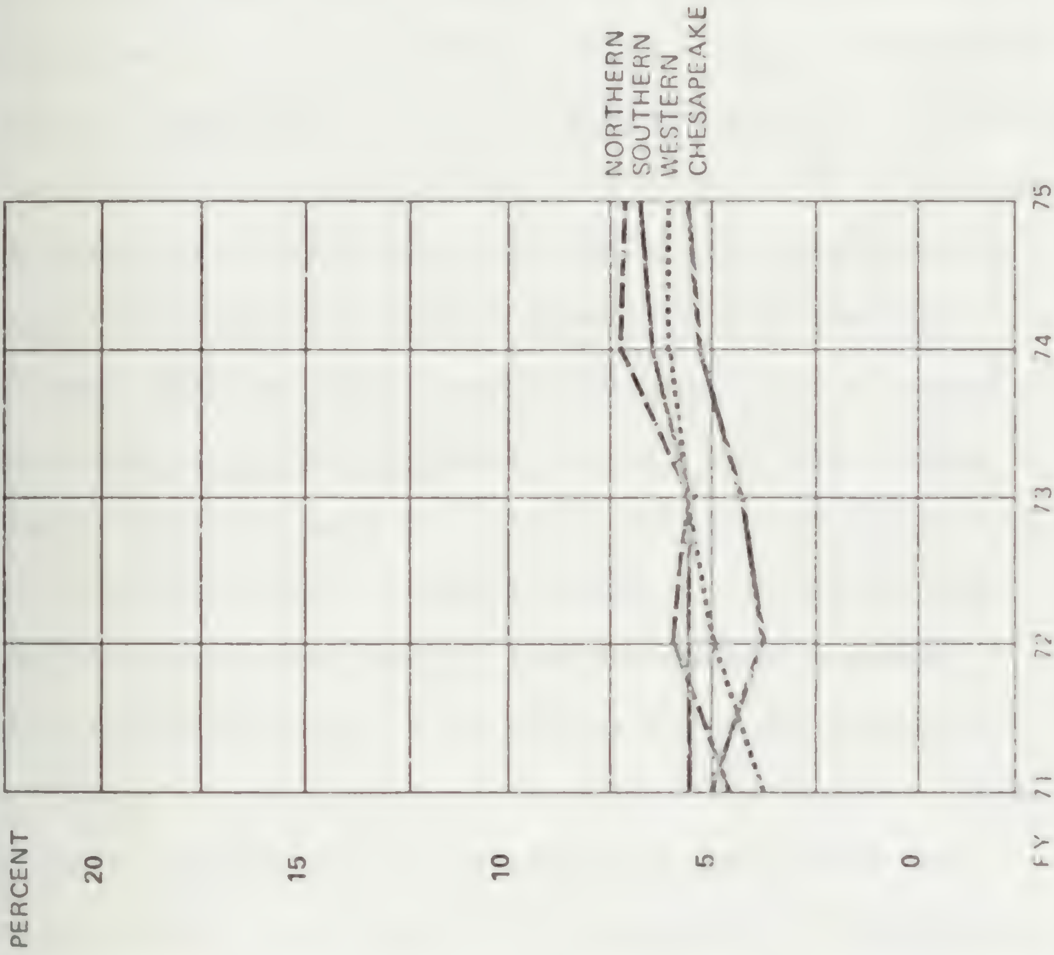
B3.3.2 WORKLOAD

Although the Heads of the four Projects Management Offices were asked the average number of projects their Project Managers were responsible for at any given time the answers were not provided on a basis which would provide a meaningful comparison.

The Project Manager is responsible for the project

FIGURE 12

PERCENT PROJECT MANAGEMENT OFFICE TO TOTAL ACQUISITION DEPARTMENT PERSONNEL INCLUDING ROICC OFFICES



SOURCE. Manpower Listings for years shown, NAVFAC.

from the time NAVFAC authorizes preliminary design (see Figure 6) to the time the construction contract is closed out. To obtain a consistant estimate which was reasonably representive of the actual workload two assumptions were made. First, the construction contracts awarded by the EFD are active for at least nine months. Considering that the average size of a construction contract awarded by the four EFDs in FY 74 was over 350 thousand dollars and that there were practically no contracts awarded by the EFDs for less than 50 thousand dollars, this seems reasonable. The second assumption was that it takes longer than six months between the time an A-E contract is awarded and the time a construction contract based on the plans and specifications prepared by the A-E can be awarded. Again considering the size of the projects involved this also appears to be a reasonable assumption. Based on these assumptions an estimate of the number of active projects during FY 75 is obtained by including all the A-E contracts awarded in FY 1975 and all the construction contracts awarded for the last nine months of FY 74 and the first six months of FY 75. As some A-E contracts that were active in FY 74 did not result in construction contracts during the first six

months for FY 75 and some construction contracts that were awarded before the first quarter of FY 74 were still active in FY 75 this estimate in only approximate. However, it is consistant and felt to be representative of the major workload. Table 5 shows the workload estimate in addition to the number of other personnel in the Project Management Offices:

It is obvious from Table 5 that there is a significant difference in the workload of the project managers as well as a significant difference in the number of other personnel.

B3.3.3 DISTRIBUTION OF WORK

The Head of each Project Management Office was asked how his project managers used their time. The average work distribution for the EFDs is shown in Table 6.

TABLE 5 ESTIMATED WORKLOAD FOR THE FOUR PROJECT MANAGEMENT OFFICES

	Number of Project Managers (1) (Including Team Leaders)	Number of Other Personnel in the Management Office (1)	Estimated Number of active projects per project manager in FY 75 (2)
NORTHERN	11	14	29
SOUTHERN	10	14	49
WESTERN	16	23	29
CHESAPEAKE	8	4	42

SOURCE: (1) Telephone interviews with the Head of the four Project Management Offices.

(2) The estimates of the workload figures are based on the number of A-E and construction contract awards taken from the Construction Summary Reports for FY 74 and FY 75. See sub-chapter B3.3.2 for a description of the estimating method.

TABLE 6 PERCENTAGE DISTRIBUTION OF THE PROJECT MANAGERS WORK EFFORT

	Design Coordination	Construction Coordination	Funding Matters	Obtaining/passing Status information
NORTHERN	60	10	15	15
SOUTHERN	60	15	20	5
WESTERN	50	10	20	20
CHESAPEAKE	35	25	25	15
AVERAGE (four EFDs)	51	15	20	14

SOURCE: Telephone interviews with the Heads of the four Project Management Offices.

The figures in Table 6 indicate that the Chesapeake Division's project managers more closely provide continuity between design and construction than do the Project Managers in the other EFDs, who spend over half their time on design and a little more than a tenth of their time on construction.

During the discussions with the Heads of the Project Management Offices, it was noted that the Western Division is the only one of the four EFDs that has its project managers writing the scope of work for A-E contracts. In the case of the other three, this function is performed by the Design Division. It was also noted that the responsibility for maintaining customer relations during the design phase was about equally split between the Project Management Office and the Design Division in the Southern, Western and Chesapeake Divisions whereas the head of the Project Management Office for the Northern Division claimed that his Project Managers handled about 70 percent of the coordination with the customer during the design process. Further Project Managers seldom review any plans and specifications and with the exception of the Chesapeake Division they only attend about half of the 30 percent and 100 percent design conferences

(these conferences are normally only held on the major projects). The Project Managers in the Chesapeake Division attended all 30 percent design conferences and most 100 percent design conferences. The fact that all of the Chesapeake Division's customers are within 1.5 to 2 hours driving distance, and most less than an hour, undoubtly helps account for this difference. (Although the other three EFDs frequently hold these design conferences at the EFD's main office and not in the field).

With respect to the Project Manager's involvement during the construction stage the Head of the Project Management Offices at the Northern and Southern Division stated that they did not participate in any pre-construction conferences or final inspections. The Western Division's Project Managers participate in 5-10 percent of the pre-construction conferences and less than 5 percent of the final inspections. At the Chesapeake Division the Project Manager participates in all pre-construction conferences for MILCON projects and 5 percent of the final inspections. The Project Managers in the Northern, Western and Chesapeake Divisions see all their major projects and some of their other projects, where the project managers at the

Southern Division see only a few of their projects. This fact must, at least partly be effected by the greater project load of the Southern Division's Project Managers. The relative involvement of the Project Management Offices in the construction process was consistent with information obtained from the telephone interviews with the Acquisition Department Heads. Each Department Head was asked to assign a percentage to the amount of information they received from various sources concerning ROICC operations. Table 7 shows the Department Heads' responses.

TABLE 7 ACQUISITION DEPARTMENT HEADS SOURCE OF INFORMATION CONCERNING ROICC OPERATIONS
(Figures in Percentages)

	Personal Observation	Project Managers	Construction Division	ROICC Prepared Reports	Design Division
NORTHERN	30	10	40	20	0
SOUTHERN	25	10	50	15	0
WESTERN	5	20	45	30	0
CHESAPEAKE	15	40	0	5	40

SOURCE: Telephone interviews with the four Acquisition Department Heads.

As can be seen by Table 7 the Chesapeake Division's Acquisition Department Head relies heavily on his project managers for information concerning ROICC operations where the Division Heads in the Northern and Southern Divisions obtain almost all of their information concerning ROICC operations from other sources. (The other significant differences between the EFDs shown in Table 7 will be discussed in subsequent chapters.

With the exception of the Chesapeake Division it is clear that the Project Management Offices are only involved with construction in a minor way and with the exception of the Northern Division it is also apparent that they perform less than half of the coordination with the customer during the design stage. The project managers' largest concern during the design stage appears in production. Their primary tasks involve getting the A-E contract awarded, establishing and maintaining production schedules, and monitoring the project cost and scope. The responsibility for product quality rests with the Design Divisions during the design phase and the responsibility for both production and product quality is essentially transferred to the ROICC after the construction contract is awarded.

B3.4 DESIGN DIVISION

B3.4.1 FUNCTION

The Design Division is responsible for executing the design phase of the Military Construction Program and for insuring the technical adequacy of the product. Among the specific tasks assigned the Design Division are:

> "Insure the technical adequacy and quality of all engineering and design.
>
> Prepare, in-house or by A-E, plans, specifications, and cost estimates for construction, repair, maintenance or alterations of shore facilities...
>
> Administer architectural and engineering contracts when engineering and design is accomplished by A-E contracts.
>
> Review designs and drawings prepared by ... architectural and engineering contractors, and construction or equipment contractors and recommend appropriate revisions to insure compliance with established criteria and sound engineering practice.
>
> Develop and establish methods and procedures for achieving the optimum levels of excellence in architecture, engineering and design in terms of appropriate quality required for the mission of the facility and the most economical design cost.
>
> Participate on boards of selection and in award of A-E and Engineering Service Contracts."(15)

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15. WESTNAVFACENGCOMINST 5450.1A 8 Jan. 1973 (other EFD's functional statements contain identical or nearly identical language.)

In comparing the formal tasks of the Project Management Office with the Design Division the former has the responsibility for getting the project moving and for monitoring progress, and the latter for performing the required coordination between the A-E and the Navy, for overseeing the technical and economical aspects for the design and for generally administering the A-E contract.

B3.4.2 ENGINEER IN CHARGE

Each Design Division has functional branches such as electrical, mechanical and architectural. Each A-E contract is assigned an engineer in charge (EIC) who is normally from the branch in which most of the project's work falls. With an EIC for each contract a large number of the Design Division's personnel are involved in administering and coordinating A-E contracts. For instance, the Western Division had 233 personnel of which 183 were engineers or architects in their Design Division on 31 December, 1974, and the Acquisition Department Head reported, during the July telephone interview that they had 120 EICs. Not considering the slight increase in the Design Division's personnel between December and July this implies that about 2/3 of the engineers and architects or about 1/2 of all

Design Division personnel were EICs. As previously discussed the primary responsibility for maintaining customer relations during the design phase varies between EFDs but generally after the A-E contract has been awarded the EIC is the primary coordinator between the A-E and customer. In addition, the EIC's job involves monitoring the A-E's progress, coordinating and expediting reviews at the 30% and 100% design stages and scheduling and conducting preliminary design conferences and other meetings as the design necessitates. In short, the EIC spends a considerable amount of his time performing management type activities. If 66 percent is representative of the percent of the engineers and architects assigned as EICs a considerable amount of the Design Division's time is spent performing management tasks.

B3.4.4 GOAL PERFORMANCE

B3.4.3.1 IN-HOUSE DESIGN

Perhaps the most influential goal, other than the pressure for production previously discussed, which a Design Division has had to respond to is an Engineering Program III goal (Program III, among the other responsibilities, is tasked with maintaining the capability to execute the design phase of the annual Military Construction Program). The goal is to insure that 25 percent of the professional manpower available in the Design Division is devoted to design efforts on major projects. Eligible projects are defined as all urgent minor construction, and all others having a construction value of $500,000 or larger. The rational behind this goal is that in order for the Design Division to maintain the ability to adequately review A-E designs and to perform in-house design in those instances where security or urgency rule out the use of A-E contractors its engineers and architects must remain current with the "state of the art" and that they can only do this "on the boards."

According to the average workload figures developed by the NAVFAC's Assistant Program Coordinator for Program III, Engineering, an engineer or architect is capable of designing 1.2 million dollars worth of

MCON funded facilities per man year or he is capable of administering 5.6 million dollars worth of MCON funded facilities designed by an A-E. These ratios vary somewhat with different types of work. In the case of MCON if each engineer was spending 25 percent of his time "on the boards" approximately 6.7 percent of the total design, in terms of its construction dollar value, would be accomplished in-house. This figure was obtained in the following manner:

Distribution of Engineers Time		Output per man year (millions)		Total Output (millions)
.25	x	1.2	=	.30
.75	x	5.6	=	4.20
				4.50

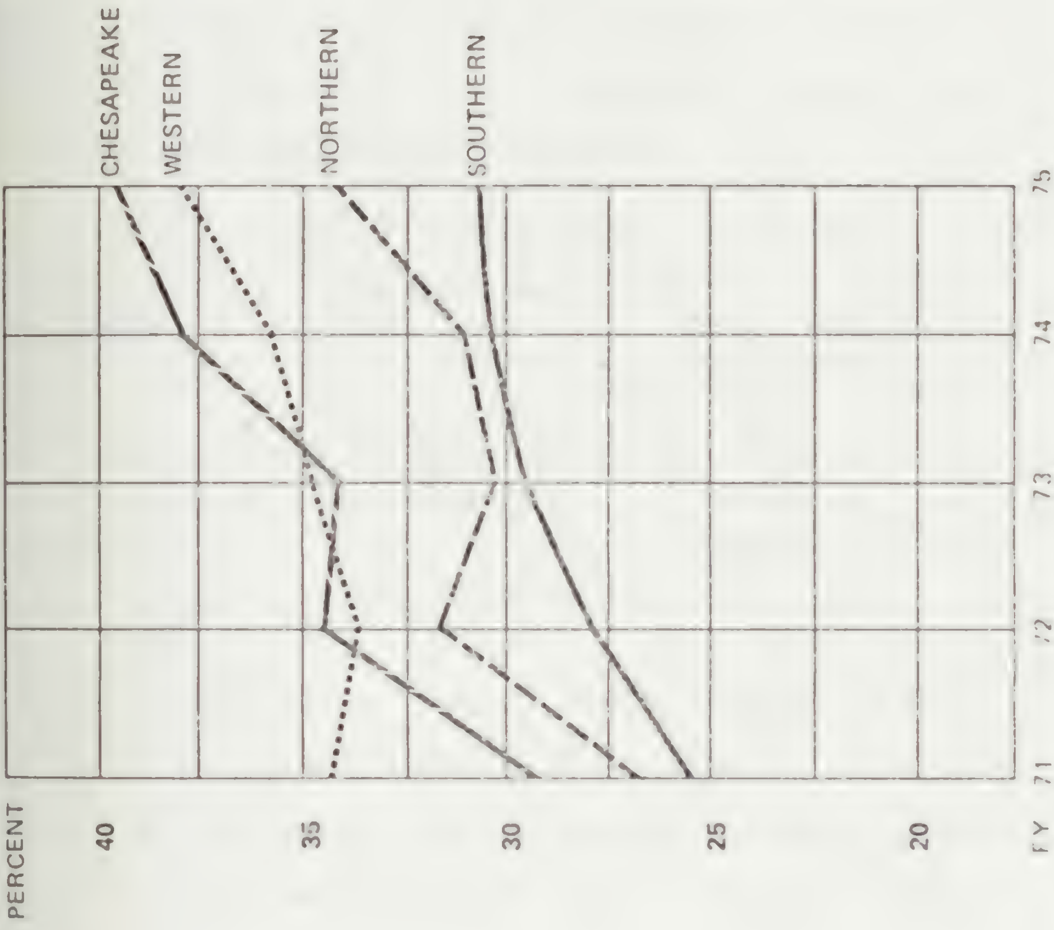
.30 / 4.50 = 6.7%

This goal has been one of the primary reasons stated for the increase in the percentage of personnel in the Design Division to the number of other personnel in the Acquisition Department and ROICC offices, over the last five years. (Figure 13).

For the purpose of illustrating the effect of this goal assume that an EFD had 100 engineers and architects and they were assigned a MCON program with an estimated construction cost of 560 million. Using

FIGURE 13

PERCENT DESIGN DIVISION TO TOTAL ACQUISITION DEPARTMENT PERSONNEL INCLUDING ROICC OFFICES



SOURCE: Manpower Listings for years shown, NAVFAC.

the output per man figure of 5.6 million for A-E contracts this would mean that the EFD could not perform any in-house design without additional personnel. To determine the number of additional personnel required to meet the 25 percent requirement the 6.7 percent figure previously derived can be used which yields the following:

560 x .067 = 37.2

Engineering Man Years		Output per man year (millions)	Total output (millions)
31	x	1.2	37.2
93	x	5.6	520.8
124			558

Where 31/124 = 25%

This obviously means that it takes 24 percent more engineers and architects if 25 percent of their time is going to be spent "on the boards" assuming everything else was held constant and the entire program was MCON.

Although the figures were not obtained, it is believed that most EFDs were spending 10 percent or less of their engineering man years "on the boards" in FY 71 which is about the time this goal was first implemented. If this was the case the goal to increase

to 25 percent is a significant change.

Although not explicitly stated it is believed that this increase in emphasis on design has resulted from the general belief that most of the problems experienced during the construction phase are a result of inadequate design. The strongest evidence of this contention is the feedback obtained from the Deficiency Analysis Data System (DADS).

B3.4.3.2 DEFICIENCY ANALYSIS DATA SYSTEM

The Deficiency Analysis Data System (DADS), was implemented by NAVFAC in September 1971 to provide an acquisition feedback system to enable management to direct their efforts to eliminating large dollar volume repetitive errors in the plans and specifications.

The system was not intended to either evaluate the product or to determine the cause of problems, rather the system was intended to locate problem areas (e.g., to categorize identified deficiencies as being in the plans or specifications but not to specify what caused the problem concerning the plans or specifications). The system requires that the ROICC, on discovery of a deficiency during an inspection, fill out a standard form and send it to the EFD. Along with providing other information he is required to categorize the

deficiency by one of the following categories; general conditions, workmanship, improper installation, improper material or equipment, plans, referenced military or federal standards and specifications, referenced NAVFAC specifications, referenced commercial standards, and other specifications not included in the above.

For the first, second, and fourth report runs from a total of 4029 DADS forms the data was amazingly consistant (results of the third report were not available). The three major problem areas were the general conditions with 8.6 percent average for the three runs, the plans with a 73.8 percent average, and the specifications (all categories) with a 12.6 percent average. The remaining 5.0 percent fell in the categories workmanship, improper installation and improper materials or equipment. The following table shows results of the combination of the three DADS reports for each EFD.

TABLE 8 PROBLEM AREAS IDENTIFIED BY THE ROICC DURING CONSTRUCTION AND REPORTED TO THE DEFICIENCY ANALYSIS DATA SYSTEM.

	General Conditions	Plans	Specifi-cations	Other Categories
NORTHERN	7.0	76.0	8.7	8.3
SOUTHERN	5.5	78.0	13.7	3.3
WESTERN	15.7	74.0	6.7	3.6
CHESAPEAKE	6.3	67.0	21.3	5.4
AVERAGE	8.6	73.8	12.6	5.0

SOURCE: NAVFAC Code 056 letter of 27 September 1974, subject Deficiency Analysis Data System

Of the problem areas categorized as being in the specifications, 18 percent were in the site work section, 27 percent were in the mechanical section and 22 percent were in the electrical section with the remaining 33 percent fairly evenly distributed between 13 other specification categories.

The DADS identified approximately three fourths of the problem areas as occurring in the plans. In order to get a more precise definition of this problem area, ROICCs were asked to assign a percentage to each of the following four possible causes (total to equal 100 percent) of problems in the plans.

(1) Lack of adequate site investigation and a thorough understanding of the peculiarities

of the site.

(2) Lack of full understanding of customers' needs.

(3) Lack of full understanding of construction practices.

(4) Just plain poor design, to include everything not listed.

The breakdown of these figures by EFD is shown in Table 9.

TABLE 9 A FURTHER DEFINITION OF PROBLEMS IDENTIFIED BY THE DEFICIENCY ANALYSIS DATA SYSTEM AS BEING IN THE PLANS

(figures are the average of the percentages ROICCs assigned to each category)

	Lack of full understanding of customer needs	Lack of adequate site investigation	Lack of understanding of construction practices	Poor Design
NORTHERN	48	14	9	29
SOUTHERN	40	20	12	28
WESTERN	40	14	14	32
CHESAPEAKE	42	18	16	24
ALL RESPONDING ROICCs	43	16	12	29

SOURCE: ROICC Questionnaire

The solution to the first cause of problems with the plans, lack of full understanding of customer needs, requires communication on a broad level. The discourse required to understand a customer's needs frequently necessitates both a broad perspective of naval operations and a detailed understanding of the immediate operational environment. The design engineer does not have, nor should he be expected to have this perspective.

The second cause, lack of adequate site investigation, requires a technical input from the Design Division. However, the decision whether or not to spend the extra time and money on a thorough site investigation entails a management decision. With the pressure to reduce design time and cost, previously discussed, the decision has generally been to minimize site investigations. Accordingly problems resulting from a lack of adequate site investigation are not fairly charged against the Design Division, as they are highly influenced by forces outside its control.

The third cause, lack of understanding of construction practices, can only effectively be solved by weeding out A-Es in the selection process who continue to demonstrate weakness in this area. Although a small improvement might be made by improved Design Division review procedures most problems in this area are subtle and

would be difficult to pick up without performing a much more thorugh review than it is the Navy's policy to perform. In order to improve the selection process the ROICC in the field who has experienced the problem must provide feedback which can be used in future selections. However, the ROICC, as he is not responsible for the design process, has little incentive to provide this feedback. As the Design Engineer communicates infrequently with the ROICC he has little chance to receive the feedback, and if he did he would have little use for it as he is normally assigned to projects on the basis of the type of work and not by geographical location which is one of the major factors considered in selecting A-Es. As the Design Division can not effectively solve this problem they can not fairly be charged with the responsibility for it.

The fourth cause, other aspects of poor design, includes the technical aspects of the design which the Design Division can control. As such they are directly responsible for only 29 percent of the problem causes identified in Table 9, and the other 71 percent require management action outside the Design Division's realm of responsibility.

B3.4.3.3 DESIGN QUALITY INDICATORS

Looking back at Table 8 it is noted that problems in the plans amounted to 73.8 percent of the problem areas identified by DADS. This would imply that 29 percent of the 73.8 percent or 22 percent of the problems identified by DADS as being in the plans are the responsibility of the Design Division. Additionally,the 12.0 percent of the problems identified by DADS (Table 8) as falling in the specifications area are the responsibility of the Design Division, and bring the total of the DADS identified problems which are the responsibility of the Design Division to slightly over 1/3. Using Table 8 and 9 this same number can be obtained for each EFD as shown in Table 10.

TABLE 10 PERCENTAGE OF PROBLEMS IDENTIFIED BY THE DEFICIENCY ANALYSIS DATA SYSTEM WHICH ARE THE RESPONSIBILITY OF THE DESIGN DIVISIONS

(all figures in percentages)

	Percent Poor Design (1) in Plans	Percent DADS identified problems in the Plans (2)	Percent of DADS identified problems which are poor design in plans	Percent DADS identified problems in the specifications	Total DADS identified problems responsibility of Design Division
NORTHERN	29	76.0	22	8.7	31
SOUTHERN	28	78.0	22	13.7	36
WESTERN	32	74.0	24	6.7	31
CHESAPEAKE	24	67.0	16	21.3	37
AVERAGE	29	73.8	21	12.6	34

SOURCE; (1) Table 9

(2) Table 8

The figure in the fifth column in Table 10 represents a relative index of design quality for the four Design Divisions. Table 11 shows this relative quality index, the percent of personnel in the Design Division and each EFD's performance with respect to the goal requiring 25 percent of their in-house engineering effort to be applied "on the boards" and the goal which sets the award of construction contracts for the prior year's Military Construction Program at 100 percent by 30 June 1975. Because many of the projects on which the ROICCs based their evaluation were designed in FY 74, the figure used for the percent of effort applied to in-house design is an average of the FY 74 and FY 75 performance levels. This comparison does not take into account the fluctuation in each EFD FY 75 workload from their average workload. Figure 8, suggests that the Southern Division was significantly over their average workload in FY 75, the Northern and Western Divisions were operating fairly near their average, and the Chesapeake Division was a little above their average.

TABLE 11 A COMPARISON OF PERSONNEL WITH PERFORMANCE INDICATORS FOR THE FOUR DESIGN DIVISIONS

	Percent Acquisition Department personnel including ROICC office personnel, in design (1)	Percent of problem identified by DADS which are the responsibility of the Design Division (2)	Average FY 74, FY 75 percent of Engineering effort applied to "in-house" design (3)	Percent of authorized program amount for FY 74 MILCON program obligated by 30 June 1975 (4)
NORTHERN	34	31	18	89
SOUTHERN	31	36	22	94
WESTERN	38	31	11	87
CHESAPEAKE	39	37	17	71

SOURCE: (1) FIGURE 13

(2) TABLE 10

(3) Supplied by Program III Assistant Program Coordination, Officer, NAVFAC.

(4) CMS goal report of 30 June, 1975

As previously explained the Chesapeake Division has an extremely high turnover which undoubtedly significantly effects their performance. Disregarding the Chesapeake Division for this reason and looking at the other three EFDs a definite pattern is noted. Looking at Table 11 it is noted that the Western Division is tied with the Northern Division with the lowest percent of problems which are the responsibility of the Design Division, has the highest percentage of Acquisition Department personnel in design, the lowest percent of engineering effort applied to in-house design and the smallest percent of their FY 74 MILCON program obligated. On the other hand, the Southern Division has the highest percent of problems which are the responsibility of the Design Division and the lowest percent of personnel in the Design Division, the highest percent of in-house design, the highest percent of their FY 74 MILCON program obligated, and appeared to be operating significantly above their average workload in FY 75 (See Figure 7).

As explained in sub-chapter B3.4.3.1 it takes significantly more people to perform design in-house than it does to contract for it. If, in addition, as in the case of the Southern Division, they are turning the design out faster as evidenced by the high percent-

age of their FY 74 MILCON program that was obligated by 30 June 1975, and they have a smaller percentage of their acquisition personnel in design, they must be spending less time than the other divisions, particularly the Western Division, on each design. The Southern Division's significantly higher percent of problems identified by DADS and defined in sub-chapter B3.4.3.2 as being the responsibility of the Design Division, suggests that quality is related to the amount of effort available for each design.

This evaluation also suggests that goal performance is a matter of commitments, not resources. It is noted from Figure 13 that there has been a slight increase in the percentage of the Acquisition Departments' personnel in the Design Divisions during the last five years. Whether this increase has sufficiently offset the requirements of the performance goals discussed, or whether or not the long range benefits of these goals offset the loss in design quality in the short term, is beyond the scope of this Thesis. What is important here, in further support of the discussion in sub-chapter B2.5 on performance goals, is that these goals do have an effect on the amount of time each EFD has available to spend on design, that

there appears to be a relationship between the time spent on design by the EFD and its quality, and there appears to be a difference in each EFD's capabilities to meet a uniform set of goals.

B3.4.4 <u>DESIGN ENGINEERS' INVOLVEMENT DURING CONSTRUCTION</u>

In an attempt to quantify the degree to which the Design Division or the A-E was involved in the construction process during FY 75, ROICCs were asked on how many of their active contracts during FY 75 did these personnel visit the site for the sole purpose of seeing how the design turned out and in a separate question, for the purpose of solving a specific design problem. The questionnaire did not distinguish between EFD projects and local OICC projects. Because the EFD projects constitute about 90% of the construction dollar value of the projects most all A-Es visiting the site would be visiting EFD projects (large dollar value projects include most of the complex projects, tend to have more problems and are of a higher interest to the A-E), and except in rare cases Design Division personnel would only be visiting EFD projects. It is therefore safe to assume that most ROICC responses to these questions dealt with EFD projects rather than those of the local OICC. In order to obtain the percent of EFD contracts to the total active contracts

each ROICC stated that he adminstered during FY 75, the ratio of local to EFD contracts was taken from the June Workload Report of the Construction Management System (CMS). These ratios were applied to the ROICC reported active contracts for each office. Table 12 shows these figures sorted by EFD and ROICC office size.

These figures show that a large percentage of the projects are never visited by the EFD Design Division or the A-E. The figures also show that there is a significant difference between EFDs. Although one would suspect the large ROICC offices with a greater percent of their workload made up with large contracts would receive more attention from the Design Division and the A-E, there is no apparent reason for the differences in the medium and small sized offices.

Table 12 further supports the general trend noted in Table 11, that the Southern Division appears to be spending less effort in the design area than the Northern and Western Divisions. Table 13 shows the cost of plans and specifications for MCON projects as a percentage of the authorized construction amount. It should be noted that this figure is for MCON projects only which, as noted in sub-chapter

TABLE 12 NUMBER OF PROJECTS VISITED BY DESIGN DIVISION PERSONNEL OR A-E DURING FY 75

	Total number of active contracts in FY 75 reported by ROICCs (2)	Number of active EFD contracts in FY 75 (1)	Number of projects visited with single purpose of seeing how the design turned out (2)	Number of projects visited to solve specific design problems (2)	Percent of projects visited both purposes to EFD projects
NORTHERN	1221	407	39	75	29
SOUTHERN	1390	526	22	78	19
WESTERN	823	270	24	36	22
CHESAPEAKE	373	75	4	18	30
TOTAL FOR ALL RESPONSES	3807 (A)	1278	89	207	23
LARGE	1258	510	49	97	29
MEDIUM	1358	418	19	54	17
SMALL	1191	350	21	56	22

NOTE: (A) This figure is the total number of contracts of the ROICCs responding to this question.

SOURCE: (1) Calculated by applying the percent of EFD contracts to total contracts for each ROICC taken from CMS June 1975 Report, to the number of active contracts reported by each ROICC.

(2) ROICC Questionnaire.

B1.4.2 amount to only 53 percent of the total value of WIP.

TABLE 13 COST OF PREPARING MCON PLANS AND SPECIFICATIONS AS A PERCENTAGE OF THE AUTHORIZED CONSTRUCTION AMOUNT FOR FY 75

NORTHERN	7.0
SOUTHERN	4.6
WESTERN	5.5
CHESAPEAKE	6.0

SOURCE: CMS 30 June 1975 goal report

Although covering only 53 percent of the WIP the above table again shows the same trend with respect to the Southern Division's effort applied to the production of plans and specifications.

The ROICC survey indicated that none of the EFDs make much utilization of either the Design Division's personnel or the A-E for routine or final inspections. The Design Division's personnel attend less than 1 percent of the final inspections, and less than 3 percent of the routine inspections. The A-E attends less than 1 percent of the final inspections and less than 5 percent of the routine inspections. These figures were calculated in the same manner as those in Table 12.

B3.5 CONSTRUCTION DIVISION

B3.5.1 FUNCTIONS

Among the tasks formally assigned the Construction Division are the following:

> "Superintend construction work performed under contract to secure economical, timely completion of the requisite quality and funded scope...
>
> Provide construction policy guidance to subordinate offices. Supervise and monitor on a regular review basis, Construction Division functions as administered by subordinate field offices.
>
> Investigate and recommend action on proposed contract changes. Negotiate changes not requiring board action, utilizing the assistance of the Contract Division. Authorize the ROICC to proceed on changes up to $10,000 pending formalization of documents.
>
> Administer construction inspection forces; budgetary requirements, allocating and assigning available personnel. Supervise training and development of inspection and supervisory personnel.
>
> Conduct or supervise the conduct by ROICC of pre-construction conferences with construction contractors.
>
> Review contractors' time schedules, maintain appraisal of contractors' capability, and take appropriate action to secure timely completion.
>
> Approve or arrange for approval of shop drawings, materials of construction, and similar submissions by contractors...

"Administer the Labor Relations Program as pertaining to construction contracts" (16)

Information collected from various sources during the preparation of the Thesis indicates that the formal tasks somewhat overstate what the Construction Dividion actually does. The following is a more realistic description of actual responsibility:

(1) Coordinates and monitors the EFD's safety program.

(2) Coordinates and monitors the EFD responsibilities in labor relations.

(3) Provides the field with a problem council and coordination service and acts as a central point of contact for ROICC offices. In so doing the Construction Division accumulates and maintains a body of information readily accessable at the EFD level, concerning the present status of projects and ROICC activities.

(4) Collects data concerning various aspects of the ROICC operation and prepares status reports.

(5) Provides ROICCs with guidance concerning inspection matters.

---

16. SOUTHNAVFACENGCOM ORGANIZATION MANUAL, 24 July 1973 (other EFD's functional statements use identical or nearly identical language.

(6) Prepares ROICC staffing studies and generally oversees and coordinates ROICC civilian personnel matters including training.

(7) Coordinates the implementation of EFD policy concerning construction matters at the ROICC level.

(8) Performs the ROICC contract administration function at a few remote sites which can be most economically handled directly by the EFD.

As shown in Figure 14 the Construction Division personnel in 1975 amounted to about 5 percent of the total Acquisition Department and ROICC office staffs, and that their strength has slightly decreased percentage wise, during the last four years. ROICC personnel as seen on Figure 15 amounted to approximately half of the total Acquisition Department and ROICC office personnel in 1975, and more than half in 1971.

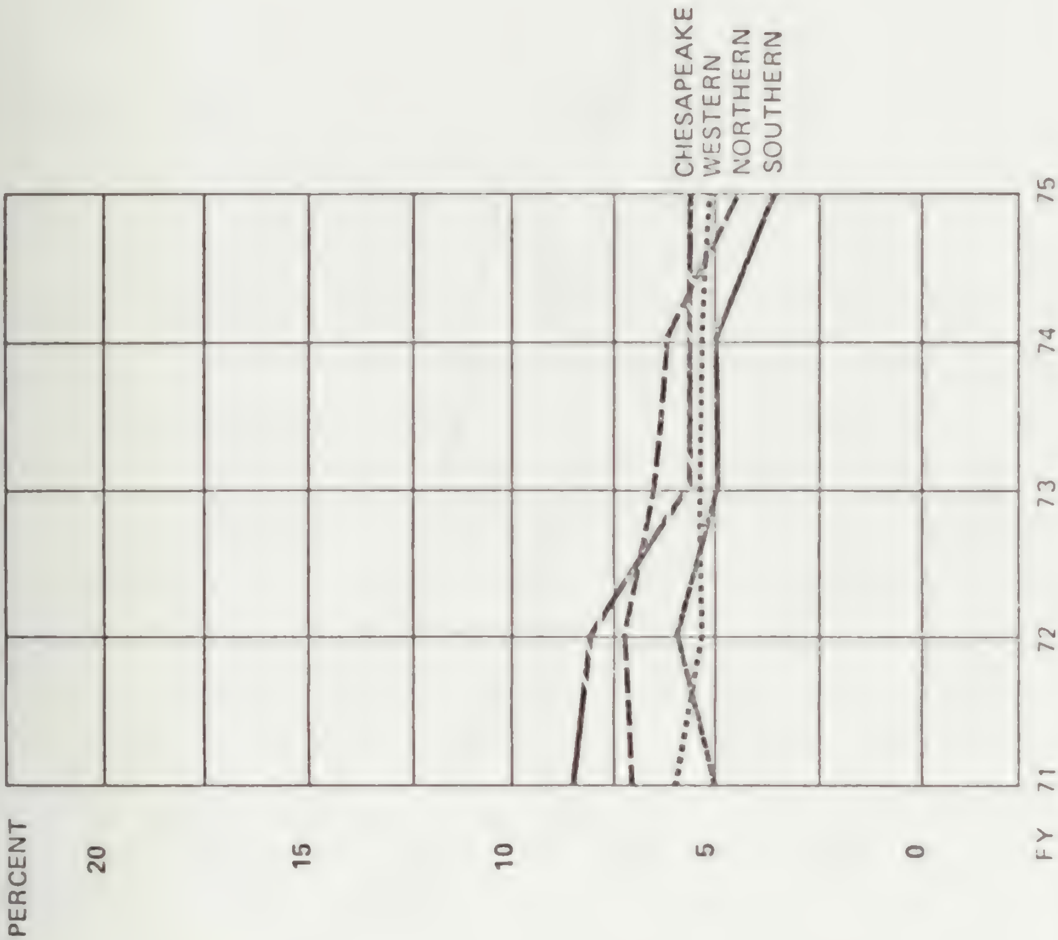
The ROICC formally reports to the Commanding Officer of the EFD as shown on Figure 5 and receives technical guidance only, from the Acquisition Department which is administered primarily through its Construction Division.

B3.5.2 COORDINATION OF FIELD PROBLEMS

One of the initial hypothesis made at the beginning of the research stage which was expressed

FIGURE 14

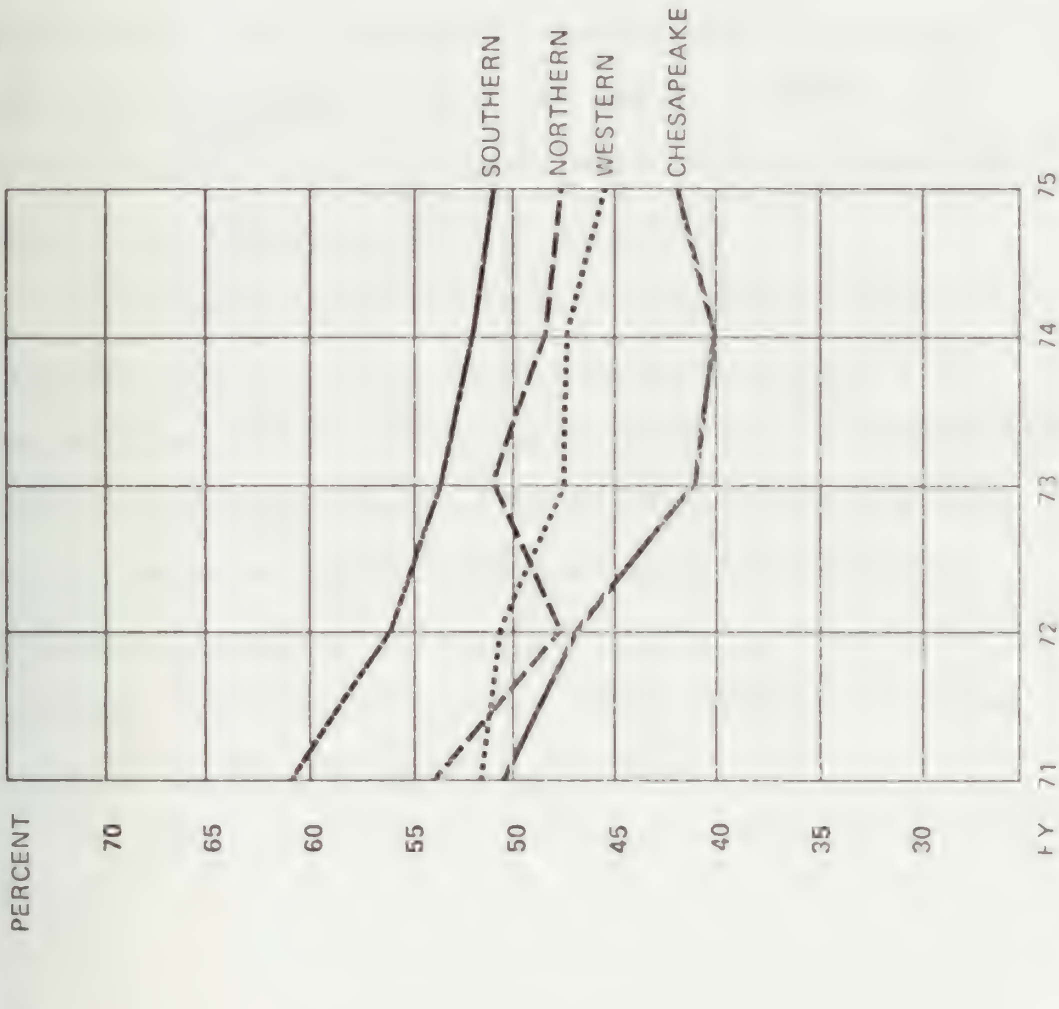
PERCENT CONSTRUCTION DIVISION TO TOTAL
ACQUISITION DEPARTMENT PERSONNEL INCLUDING ROICC OFFICES



SOURCE: Manpower Listings for years shown, NAVFAC.

FIGURE 15

PERCENT ROICC PERSONNEL TO TOTAL ACQUISITION DEPARTMENT INCLUDING ROICC OFFICES



SOURCE: Manpower Listings for the years shown, NAVFAC.

in the letter forwarding the ROICC questionnaire (Appendix B) was, that in carrying out the problem coordination and counciling service the Construction Division acted as a screen between the other elements of the EFD and the ROICC offices and that this was detrimental. The survey did verify that the largest percentage of communication between the ROICC and the EFD (except for the Chesapeake Division) was conducted with the Construction Division.

The responses to the questionnaire from the Northern, Southern, and Western Division ROICCs indicated that the frequency with which they communicated with the different components of their EFDs was very nearly the same. The Chesapeake Division's ROICC offices differed considerably. Table 14 shows the responses for the first three EFDs combined with the response for the Chesapeake Division.

TABLE 14 FREQUENCY OF COMMUNICATION BETWEEN THE ROICC AND THE MAJOR SUBDIVISIONS OF THE ACQUISITION DEPARTMENT AS REPORTED BY THE ROICC
(figures in percentages of responding ROICCs in each category)

Frequency Classification	Project Management Office	Construction Division	Design Division	Contract Division
NORTHERN, SOUTHERN, AND WESTERN DIVISIONS				
Frequent	14	97	12	52
Periodic	40	3	57	22
Seldom	19	0	11	9
Very Seldom	27	0	20	17
CHESAPEAKE DIVISION				
Frequent	75	25	75	0
Periodic	25	75	25	50
Seldom	0	0	0	25
Very Seldom	0	0	0	25

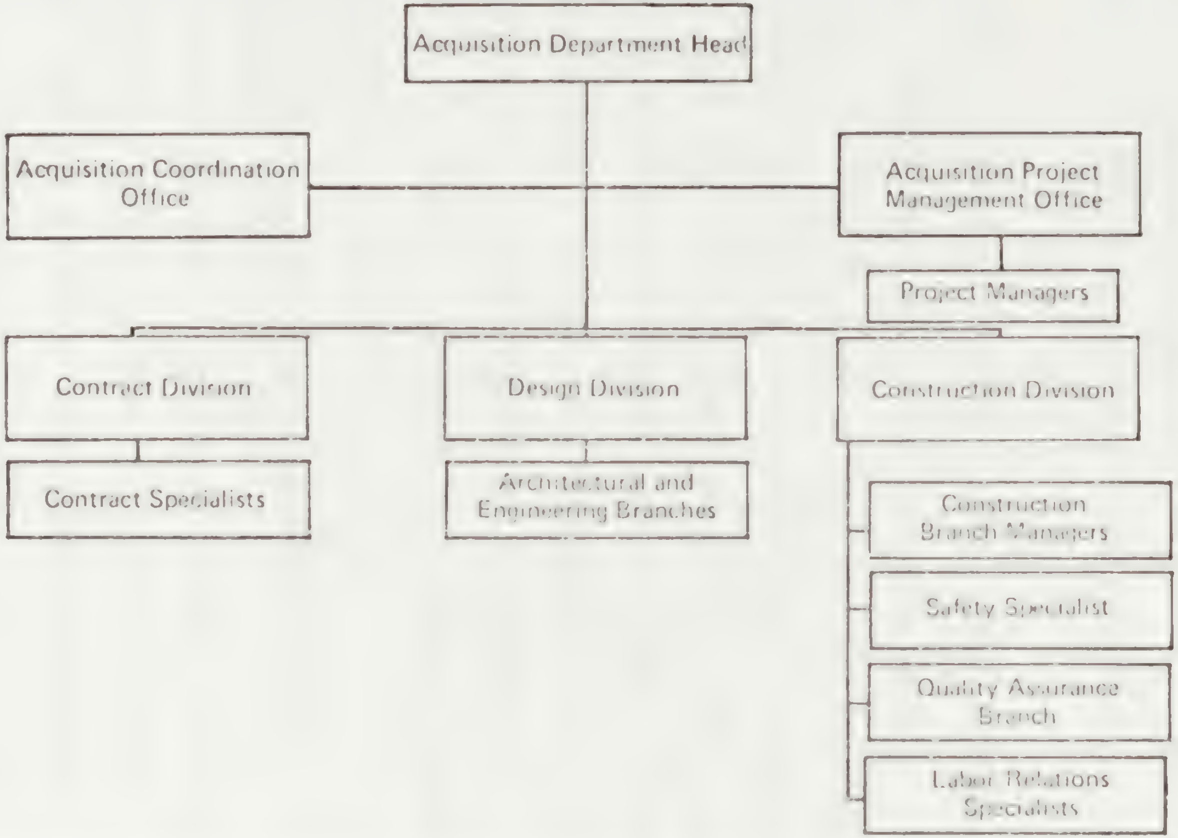
SOURCE: ROICC Questionnaire

The coordination and information collecting functions which may consume as much as a third of the Construction Divisions' efforts in the Northern, Southern and Western EFDs are the responsibility of the Construction Branches, a sub-unit within the Construction Division (see the Acquisition Department organization chart, Figure 16). The Chesapeake Division dissolved their Construction Branches three to four years ago. The primary reason stated for dissolving these branches and essentially eliminating the coordination and information collecting function was that with the close proximity of all the Chesapeake Division's ROICC offices there was not a need for a readily accessible body of information, in the EFD, concerning ROICC activities. As a result the ROICC offices in the Chesapeake Division communicate directly with whomever they need to.

Unfortunately the question in the survey which dealt with the subject matter of the communications between the ROICC and the EFD was not properly stated. As a result the responses to it cannot meaningfully be compared with responses to another question concerning the point of contact for the communications. However, comparing the Chesapeake Division's communication patterns with the other three EFDs does indicate that

FIGURE 16

TYPICAL EFD ACQUISITION DEPARTMENT ORGANIZATION CHART



the communication patterns are significantly different without the Construction Branches, and suggests that the Construction Division may in fact be acting as a screen between the ROICC and the Design Division.

When asked to rate the value of the coordination function the Construction Division performs on a scale from -4 to +4 the average of the ROICC responses was +2.2 with only four negative responses. The highest of the three EFDs was the Northern Division with a rating of +2.4, followed by the Southern Division with a rating of +2.2, and the last, the Western Division, had a rating of +1.9. This does indicate that the coordination services, from the ROICC viewpoint, is worth at least half of its positive potential.

B3.5.3 VALUE OF THE CONSTRUCTION DIVISION TO THE ACQUISITION DEPARTMENT HEADS

As previously stated, one of the primary values of having a central point of contact within the EFD for the ROICC offices is that it provides the Head of the Acquisition Department with a readily accessible body of knowledge concerning project status and ROICC activities.

Table 15 shows the value to the Department Heads, of five of the eight Construction Division functions listed in sub-chapter B3.5.1. The functions omitted

TABLE 15 VALUE OF THE CONSTRUCTION DIVISION'S PRIMARY FUNCTIONS AS SEEN BY THE ACQUISITION DEPARTMENT HEAD

(Rating on a scale of 1-5 with 5 the most valuable)

	Provide Accessable Information Concerning project status/ROICC activities	Collect Data and Prepare Status Reports	Provide ROICC offices with guidance concerning inspection matters	Prepare ROICC staffing studies and oversee ROICC personnel matters	Coordinate the implementation of policy at the ROICC level
NORTHERN	3	4	4	3.5	4
SOUTHERN	5	5	5	5	5
WESTERN	5	4	5	5	5
CHESAPEAKE	0 (1)	4	3	5	4
AVERAGE	4.3	4.3	4.3	4.6	4.5

(1) Not in average

SOURCE: Telephone interview with Acquisition Department Heads (See Appendix 4)

were those dealing with the Construction Divisions responsibility to coordinate and monitor the EFD's labor relations and safety programs and their responsibility to perform the ROICC function at remote isolated sites.

In a separate question the results of which were reported in Table 7 the Department Heads, with the exception of the Chesapeake Division, reported that they obtained 45 percent of their information concerning ROICC activities from the Construction Division, which was by far the largest source of their information. Obviously the services the Construction Division performs are extremely valuable in the minds of the Acquisition Department Heads.

B3.6 PROBLEMS IN THE ACQUISITION PROCESS FROM THE ACQUISITION DEPARTMENT HEADS' POINT OF VIEW

In order to put the various problems discussed in the acquisition process in perspective the Acquisition Department Heads were asked what percentage of the total problems in the design and construction process, that came to their attention, would they assign to the following four categories:

(1) Problems under the ROICC control such as timely completion, poor quality.

(2) Problems in the plans and specifications.

(3) Customer problems, such as, customers changing their minds.

(4) All others to include, unforeseeable site conditions, national material shortages that were unknown at the time of design, changed operational requirements that a customer would not have anticipated.

The Southern Division's Department Head felt he could not assign percentages to the above categories with reasonable accuracy. The responses of the other three are shown in the following table.

TABLE 16 PROBLEMS IN THE ACQUISITION PROCESS AS SEEN BY THE ACQUISITION DEPARTMENT HEADS

(figures in percentages assigned by each Department Head)

	Problems Under ROICC Control	Problems in Plans & Specifications	Customer Caused Problems	Other
NORTHERN	25	25	25	25
SOUTHERN (A)				
WESTERN	30	20	30	20
CHESAPEAKE	15	30	50	5
AVERAGE	23	25	35	17

(A) The Department Head felt he could not assign percentages to the above categories with reasonable accuracy.

SOURCE: Telephone interviews with the Acquisition Department Heads

The Acquisition Heads were then asked, with respect to the problems that they had said were under the ROICCs control, what percentage they would assign to five problem categories. Table 17 shows the responses to this question.

Although these figures are rough approximations based on impressions and do not represent all four EFDs they do give an order of magnitude to the various problem areas from which the more specific problems discussed elsewhere in the Thesis can be put in perspective. As the question to the Department Heads was phrased, "problems that come to your attention," the figures in Tables 16 and 17 do not represent all the problems but should represent all major problems. Although the nature of the problems concerning the plans and specifications that reach the Department Head may not contain the same proportional composition of sub problems that have been determined to exist at the ROICC level there is no reason to believe that what the Department Head sees is not representative of the problems viewed by the ROICC. Therefore this will be assumed to be the case. As such Table 9, which shows how the ROICC's view the problems in the plans and specifications, can be restated in terms of Table 16 which shows the percentage of the problems in the acqui-

TABLE 17 PROBLEMS UNDER THE COGNIZANCE AND GENERAL CONTROL OF THE ROICC AS VIEWED BY THE ACQUISITION DEPARTMENT HEADS

	Inadequate Inspection	Poor customer coordination/ relations	Poor contractor relations	Poor contract administration procedures	Other
NORTHERN	25	20	15	20	20
SOUTHERN (1)					
WESTERN	10	10	30	30	20
CHESAPEAKE (1)					
AVERAGE	17	15	23	25	20

(1) These two Acquisition Department Heads felt that they could not assign percentages to the above categories with reasonable accuracy.

SOURCE: Telephone interviews with the Acquisition Department Heads.

sition process the Acquisition Department Heads attribute to the category, "problems in the plans and specifications". In a like manner Table 17 which shows the problems under the cognizance and general control of the ROICC can also be restated under the overall category "problems under ROICC control" (in Table 16). Table 18 shows Tables 9 and 17 restated with respect to the overall problem categories identified in the column headings of Table 16.

In addition to restating Table 9 and 17, Table 18 classifies the problems as management, technical and other. This classification is based on the type of skills and level of authority needed to solve each problem. The solution the category of problems in column 3 Table 18, "Customer Problems", which includes problems such as customers changing their minds is through the application of behavioral skills, through a thorough understanding of the flexability and rigidity of the various aspects of the acquisition process, and through an understanding of both the overall and the immediate operational environments within which the customer is operating. This problem clearly requires a management perspective, as do the problems under ROICC control (column 1, Table 18) "poor customer

TABLE 18 A FURTHER DEFINITION OF THE PROBLEMS IN THE ACQUISITION PROCESS AS SEEN BY THE ACQUISITION DEPARTMENT HEADS

Column Headings From Table 16	Problems Under The ROICC Control					Problems in the Plans and Specifications				Customer Problems	Other	Total
Percentages From Tables 16	23					25				35	17	100
Abbreviated Column Headings From Tables 9 and 17	Inadequate Inspection	Poor Customer Relations	Poor Contractor Relations	Poor Contract Administration	Other	Customer Needs	Site Investigation	Construction Practices	Poor Design			
Percentages from Tables 9 and 17	17	15	23	25	20	16	43	12	29			
Restated Percentages for Column (Totals to 100% Horizontally)	4	3	5	6	5	4	11	3	7	35	17	100
Management Problems		3	5			4	11	3		35		61
Technical Problems	4			6					7			17
Other					5						17	22

SOURCE: Tables 9, 16 and 17.

relations" and "poor contractor relations". Sub-chapter B3.4.3.2 presents a similar argument for why the solution to three of the four problems in the plans and specifications (column 2, Table 18) identified in Table 9 require management action and why only the problem "other aspects of poor design" is within the technical control of the Design Division. The two problems under ROICC control, "inadequate inspection" and "poor contract administration procedures" are classified as technical as their solution is through improving the technical knowledge of the ROICC staff in these areas.

In summary, about 7 percent of the major problems experienced by Acquisition Departments as seen by the Acquisition Department Heads are the technical responsibility of the Design Division, about 10 percent of the problems are technical responsibility of the ROICC and about 61 percent of the overall problems can be classified as management problems. The remaining 22 percent of the problems as seen by the Acquisition Department Heads, fall in the "other" category. Although the estimates supplied by the Acquisition Department Heads are very rough the order of magnitude strongly suggests the major problems, by a considerable

SECTION B, RESEARCH FINDINGS

CHAPTER 4 CONSTRUCTION CONTRACT ADMINISTRATION

B4.1 CHAPTER OVERVIEW

This chapter will examine several of the differences and similarities between the ROICC offices of the four EFDs under study.

As explained in Chapter B1 the four EFDs have a total of 60 ROICC offices. Of these 60, 15 are in the Northern Division, 16 in the Southern Division, 19 in the Western Division and, 10 in the Chesapeake Division. Of the total of 60 offices, 13 placed more than 15 million dollars of work in place during FY 75 and for the purpose of the Thesis have been classified as large offices, 18 offices placed from 5 to 15 million of WIP and are classed as medium sized offices, and the remaining 29 offices placed between 1 and 5 million dollars of work in place during FY 75 and are classed as small offices.

Figure 17 shows the ROICC offices by their geographical location and their size classification. As can be seen almost all of the offices are located near the Atlantic, Pacific or Gulf Coasts.

After identifying the formal functions of the ROICC and generally describing the ROICC office organization, ROICC staffing and workload will be evaluated

FIGURE 17

RESIDENT OFFICER IN CHARGE OF CONSTRUCTION OFFICE LOCATION

for each EFD over a five year period in order to identify the magnitude of the gap between workload and staffing that occurs in peak and slack periods. An attempt will then be made to find a basis for comparison between the EFDs. The comparison which occupies a good portion of this chapter will result in redistribution of each EFD's ROICC personnel based on the work in place and number of contracts for each ROICC office considered simultaneously.

This comparison will be followed by a brief discussion of future workload and a discussion of the results of a recent NAVFAC "market survey".

In a further discussion of ROICC performance indicators ROICC offices will be sorted by those who met over 50 percent of their promised beneficial occupancy dates (BOD) during FY 75 and those who did not. The differences in these two groups will then be evaluated.

The chapter will then turn to a discussion of the Navy's inspection process which will include a discussion of the current use of inspection planning techniques, and the role of the Navy inspector.

The chapter will conclude with an evaluation of the ROICC's involvement in the design process.

B4.2 RESIDENT IN CHARGE OF CONSTRUCTION FUNCTIONS

The functions of the ROICC as formally described are:

> "Administer the contractor Labor Relations Program and the Construction Safety Program.
>
> Supervise the execution of contract work within assigned area, and prepare all routine and technical reports.
>
> Inspect all contracts assigned...
>
> Maintain liaison with the Engineering Division of the activity public works department and the ...(EFD) or the A-E firm in preparation of plans and specifications for projects to be accomplished within the authority assigned.
>
> Assign and provide techical assistance to activity inspectors.
>
> Negotiate change orders and provide members for change order boards as appropriate.
>
> Process contractor payment requests.
>
> Provide liaison between the activity and the ...(EFD)."(17)

Essentially the ROICC is responsible for taking the contract at the point of award and insuring that

17. WESTNAVFACENGCOMINST 5450.1A, 8 Jan. 1973 (other EFD's functional statements contain identical or nearly identical language).

it is built in accordance with the plans and specifications, for accepting the finished facility for the Navy and for turning it over to the customer for his use. As the ROICC does not have any contract authority by virtue of his position as ROICC, the contract instruments he executes are executed in the name of the field OICC or the EFD. As previously explained the field OICC and the ROICC are the same person in most instances.

B4.3 ORGANIZATION

The organization of the ROICC offices differ as there is no rigidly established organization form, however almost all of their personnel can be categorized into three groups, inspectors, clerical and procurement personnel, engineers and CEC officers. Overall approximately 1/2 of the personnel are in the former category and about 1/4 in each of the latter two categories. Full time officers and engineers about equally divide the 1/4 of the total they represent. Additional duty officers are not counted in these figures. Less than 2 percent of the personnel fit in other categories.

Each of the 60 offices is under the charge of a CEC officer with the title Resident Officer in Charge of Construction. The grade levels of these ROICCs

range from full time Commanders or additional duty Captains in the case of large offices, to an additional duty Lieutenant in the case of the small office. Almost without exception the additional duty personnel have their primary duty as Public Works Officer. Of the sixty offices there are only 7 full time ROICCs. The involvement of the additional duty ROICC will vary from periodic reviews of the office's operation to spending two to three hours a day solving ROICC problems. Full time officers assigned to the ROICC staffs range from six in one of the large offices to none in some small offices.

Generally the officers and engineers act as contract administrators, project managers (construction phase only) and office managers. The inspectors inspect the work, administer the labor relations and safety programs and perform a number of administrative tasks associated with each contract. The procurement specialist, which is a sub-professional grade, performs the many administrative tasks associated with contract administration. In small offices the procurement and clerical functions are usually performed by one person but they are separated with more specialized personnel performing these functions in the larger offices. Almost all of the personnel in the "other" category

are in the larger offices where even further specialization can be afforded. These "other" personnel include draftsman, engineering technicians, and professional grade contract specialists.

Table 19 shows the percent distribution of personnel in each category by EFD. These figures are based on the manpower listing of 31 December, 1974, for the 60 ROICC offices under discussion. As can be seen the only significant differences in this distribution when sorted by size of ROICC offices, is that there are 6 percent more officers and engineers in the large offices and 5 percent more procurement and clerical personnel in the small offices. At least part of the former can be explained by the fact most of the 7 full time ROICCs are in the larger offices where the medium and small sized offices have additional duty ROICCs. The latter is a result of the inefficiency in the size of several very small offices that are forced to employ a full time secretary where less than a full man year is required.

As can be seen from Table 19 the Northern, Southern, and Western Divisions have an almost identical distribution of personnel types. The Chesapeake Division has more engineers and officers, and significantly fewer inspectors. The fact that a greater percentage

TABLE 19 PERCENTAGE OF ROICC OFFICE PERSONNEL BY FUNCTIONAL GROUPS

	Officers & Engineers (A)	Inspectors	Procurement & Clerical	Other including Engineering Technicians GS-11 Contract Specialists
NORTHERN	24	51	22	3
SOUTHERN	25	52	23	0
WESTERN	24	54	21	1
CHESAPEAKE	30	41	26	3
ALL OFFICES	27	49	22	2
LARGE	31	47	21	1
MEDIUM	27	49	21	3
SMALL	25	47	26	2

(A) Additional Duty Officers not included

SOURCE: 31 December 1974 Manpower Listing

of the Chesapeake Divisions workload is composed of complex R&D type facilities may account for at least part of this difference.

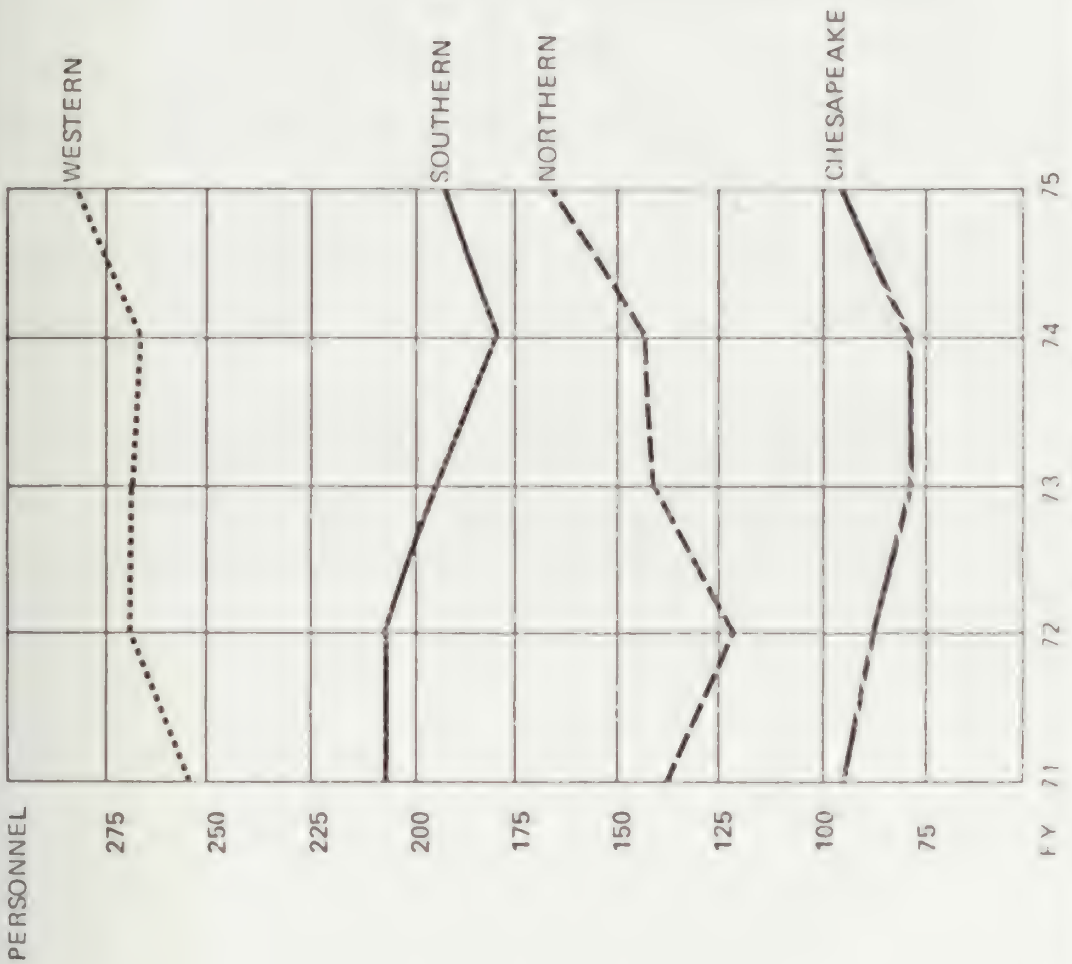
B4.4 STAFFING AND WORKLOAD

B4.4.1 VARIATION IN ROICC OFFICE PERSONNEL AND WORK IN PLACE LEVELS

In order to determine if there were any consistant trends in the amount of output, work in place, with relation to input, personnel, for the four EFDs the relationship of these two figures was examined over a five year period. In order to compare the actual workload a constant dollar was used which was derived using the Engineering News Record Building Cost Index. For reference Figure 18 shows the number of personnel in each EFD's ROICC offices over the last five years. Table 20 shows WIP, in FY 71 dollars per man year.

FIGURE 18

ROICC PERSONNEL BY ENGINEERING FIELD DIVISION



SOURCE: Manpower Listings for years shown, NAVFAC.

TABLE 20 ENGINEERING FIELD DIVISION WIP IN CONSTANT FY 71 DOLLARS DIVIDED BY THE NUMBER OF ROICC OFFICE PERSONNEL

(figures in millions of dollars per man)

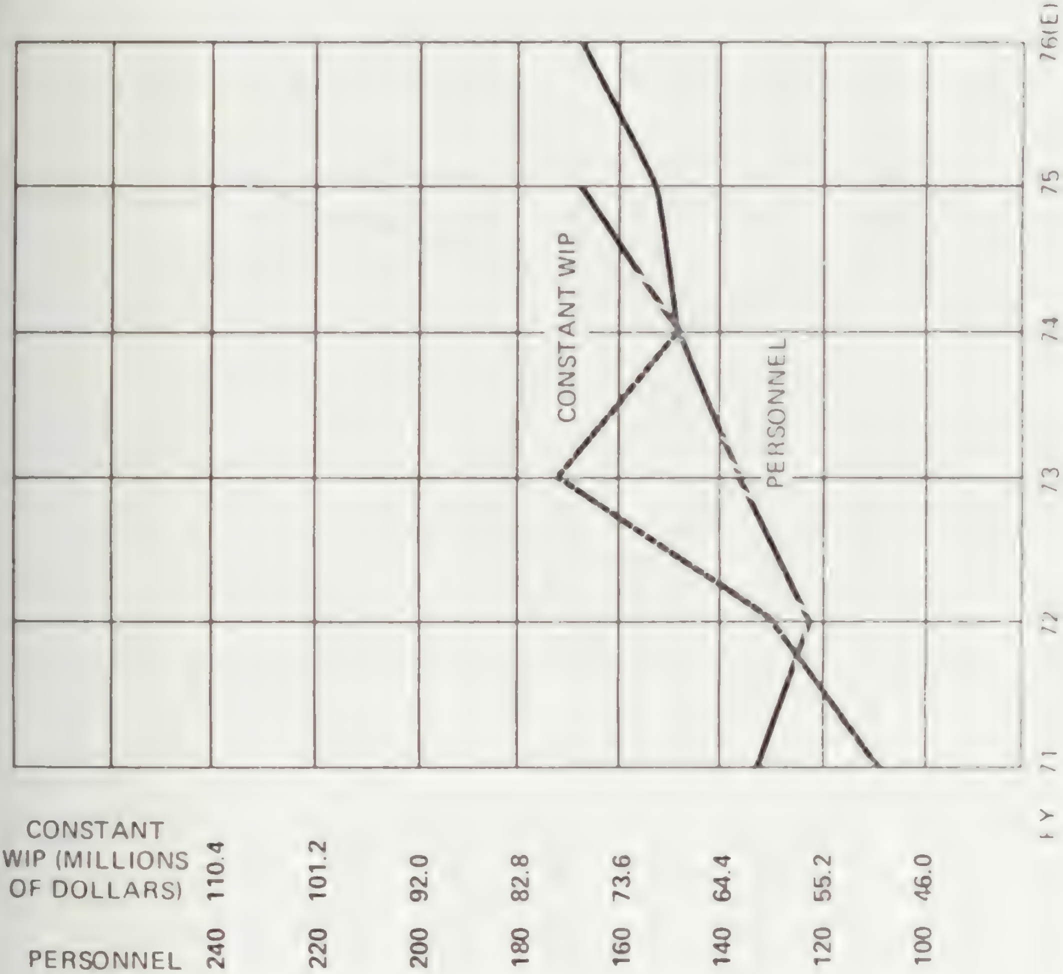
Fiscal Year	71	72	73	74	74	Average
NORTHERN	.37	.49	.57	.46	.41	.46
SOUTHERN	.49	.48	.43	.49	.73	.52
WESTERN	.45	.52	.56	.49	.49	.50
CHESAPEAKE	.49	.44	.48	.72	.66	.56
AVERAGE	.45	.48	.51	.54	.57	.51

SOURCE: Historical WIP figures supplied by the Program IV Coordination Office, NAVFAC, and personnel figures are from the manpower listings, Constant dollars were obtained from ENR's Building Cost Index.

A reasonable method of determining staffing levels would be on a three to five year workload average. In order to compare the differences between the workload and staffing levels of the four EFDs over a five year period each EFD's workload was graphed with relation to their personnel strength. The personnel and workload scales were adjusted on the basis of the five year constant WIP per man year average derived in Table 20. This adjustment was made by first setting the personnel scales and then multiplying each number on the personnel scale by the 5 year WIP/man year average. The product of this calculation is the WIP scale. Figures 19 - 22 show graphs developed in this manner for each of the four EFDs. As the graphs do not compare the EFDs with each other (they only compare the workload with the personnel for a given EFD) the variations above and below the crossing of the two lines should balance to zero. Further when the WIP line is above the personnel line the workload is greater than the staffing, and when the personnel line is above the WIP line the EFD is in a slack period with comparison to their workload. If the EFD had been staffed at their average workload level for each of the years shown the staffing and

FIGURE 19

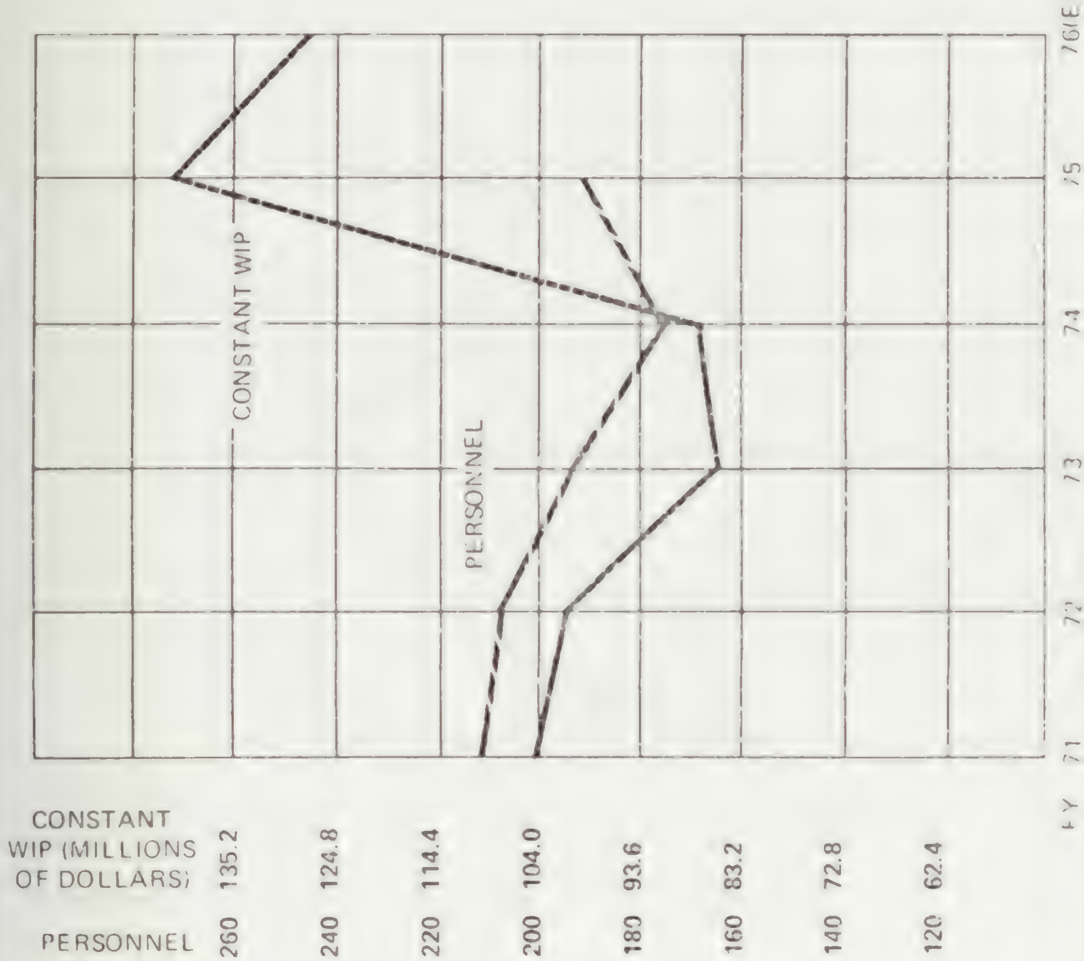
NORTHERN DIVISION ROICC OFFICES.
CONSTANT WIP IN FY 71 DOLLARS PLOTTED AGAINST ROICC PERSONNEL
WITH SCALES SET ON THE BASIS OF THE 5 YEAR AVERAGE
OF WORK IN PLACE PER MAN YEAR.



SOURCE: Constant WIP scale adjusted to personnel scale on basis of 5 year WIP/man year average derived in Table 20. Personnel from Figure 18. FY 71 constant WIP from Figure 8.

FIGURE 20

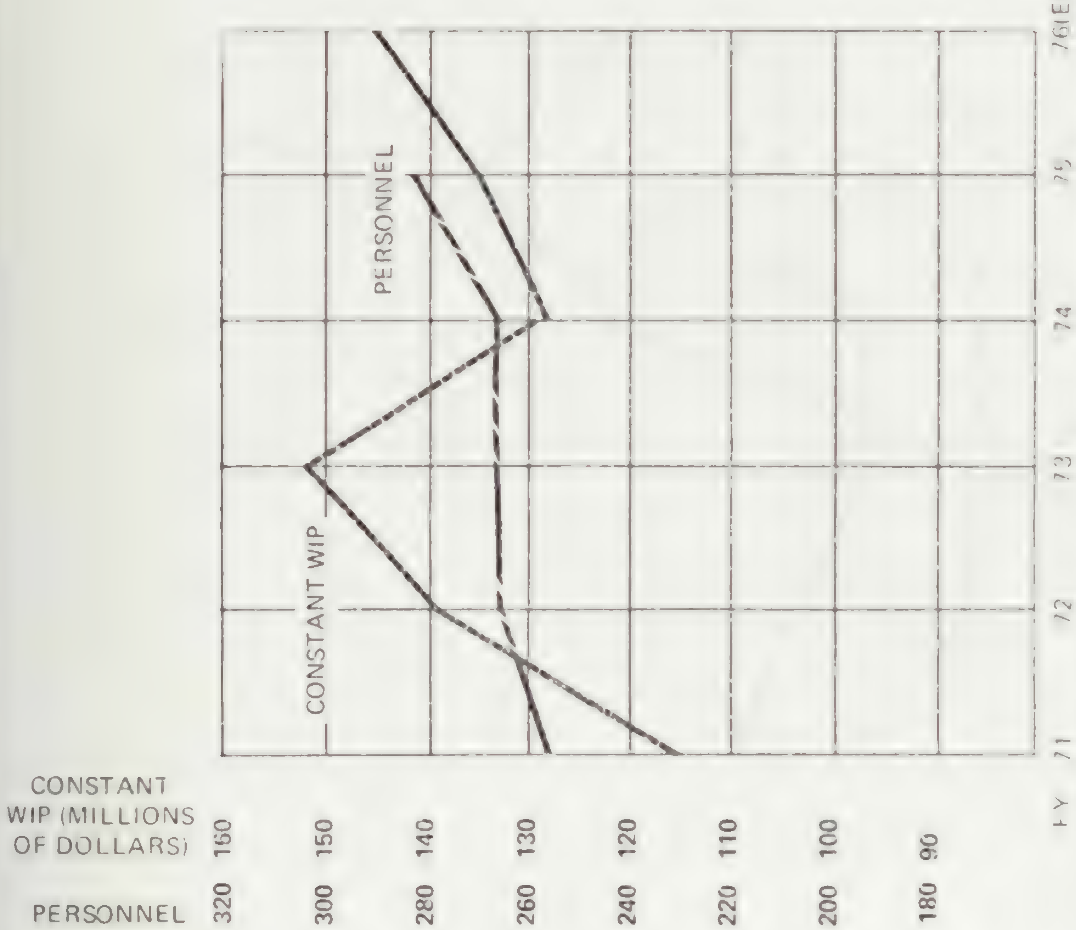
SOUTHERN DIVISION ROICC OFFICES.
CONSTANT WIP IN FY 71 DOLLARS PLOTTED AGAINST ROICC PERSONNEL
WITH SCALES SET ON THE BASIS OF THE 5 YEAR AVERAGE
OF WORK IN PLACE PER MAN YEAR.



SOURCE. Constant WIP scale adjusted to personnel scale on basis of 5 year WIP/man year average derived in Table 20. Personnel from Figure 18. FY 71 constant WIP from Figure 8.

FIGURE 21

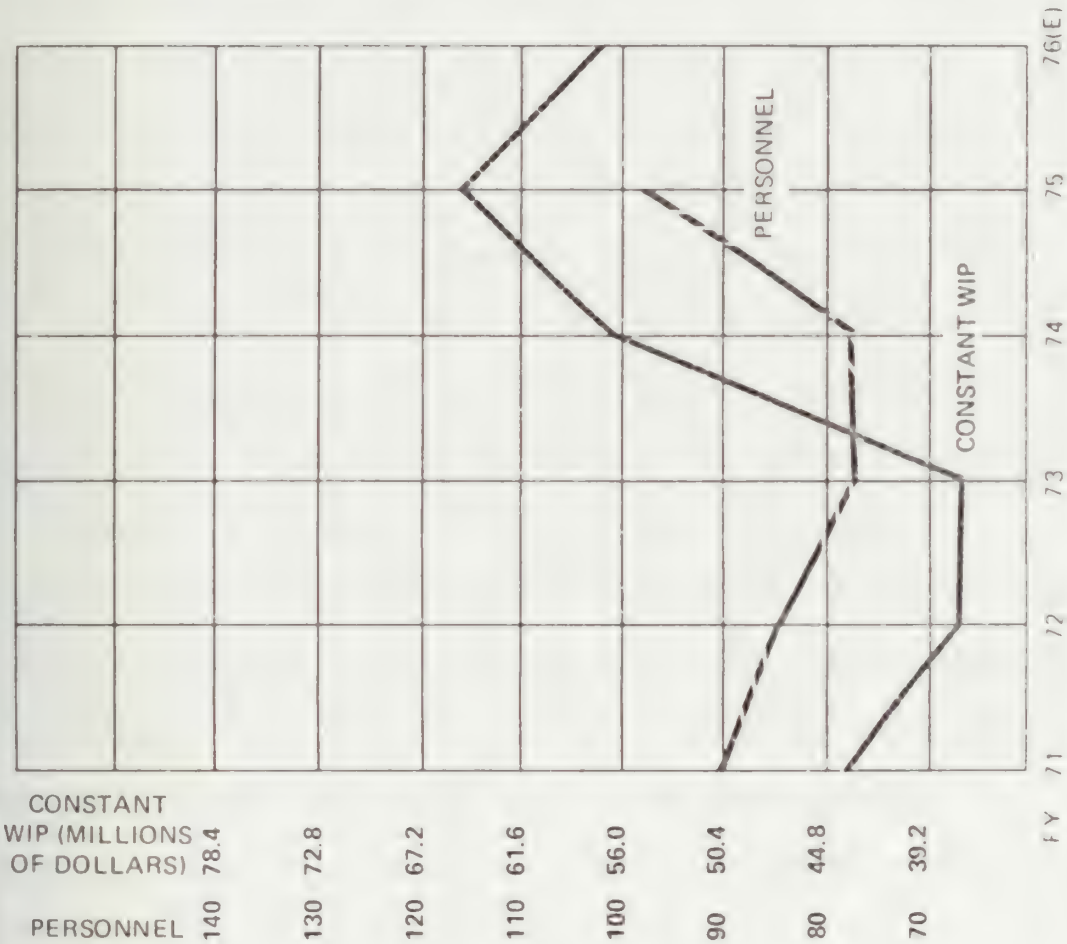
WESTERN DIVISION ROICC OFFICES.
CONSTANT WIP IN FY 71 DOLLARS PLOTTED AGAINST ROICC PERSONNEL
WITH SCALES SET ON THE BASIS OF THE 5 YEAR AVERAGE
OF WORK IN PLACE PER MAN YEAR.



SOURCE Constant WIP scale adjusted to personnel scale on basis of 5 year WIP/man year average derived in Table 20. Personnel from Figure 18. FY 71 constant WIP from Figure 8.

FIGURE 22

CHESAPEAKE DIVISION ROICC OFFICES.
CONSTANT WIP IN FY 71 DOLLARS PLOTTED AGAINST ROICC PERSONNEL
WITH SCALES SET ON THE BASIS OF THE 5 YEAR AVERAGE
OF WORK IN PLACE PER MAN YEAR.



SOURCE: Constant WIP scale adjusted to personnel scale on basis of 5 year WIP/man year average derived in Table 20. Personnel from Figure 18. FY 71 constant WIP from Figure 8.

workload lines would be identical. As can be seen by examining these four figures the magnitude of the differences between the two lines vary between each EFDs. The largest variation for the four EFDs is noted in Figure 20. The Southern Division went from a moderately slack period in fiscal years 71 through 74 to a tremendous peak in FY 75. If these figures are representative of the actual workload (they consider only one aspect of workload, dollars) one would suspect that the level of the Southern Division's performance in FY 71-74 would be significantly higher than their 75 level. As their workload is expected to decrease in FY 76 there is little justification to add permanent staff to handle the one year increase. This would mean that the Southern Division should not have been considered to have the same capability during FY 75, as the Western or Northern Divisions who by this analysis were in a slack period. (Figures 19 and 21).

However these figures only compare the EFD with itself and only with respect to the dollar value of their workloads. The figures do not indicate what differences, if any, there are between the staffing and the other factors that effect actual workload of the four EFDs.

As a first step in examining some of the other factors effecting workload the three size categories of ROICC offices were examined, in terms of their efficiency.

B4.4.2 VARIATION IN COSTLINESS OF THE THREE SIZE CATEGORIES OF ROICC OFFICES

As one would suspect the larger ROICC offices are considerably less costly than the smaller ones. In fact the costliness of the large offices is only about half that of the small offices.

The figures in Table 21 show the WIP per man year for FY 75, by EFD and size of ROICC offices. As WIP figures were not available for ROICC offices over the last 5 years it was only possible to examine FY 75.

TABLE 21 FY 75 WORK IN PLACE PER MAN YEAR, BY EFD AND SIZE CATEGORY OF ROICC OFFICE
(figures in millions of dollars per man)

	Large ROICC	Medium ROICC	Small ROICC	Other
NORTHERN	.85	.60	.47	1.08
SOUTHERN	1.15	1.10	.80	.24
WESTERN	.98	.59	.43	.36
CHESAPEAKE	1.20	.61	.64	14.80(A)
ALL ROICC OFFICES	1.12	.75	.64	

(A) This figure represents WIP for some of the Chesapeake Division's special responsibilities.

SOURCE: WIP figures from CMS June 75 report, and personnel figures from 31 Dec. 1974 manpower listings.

The figures in Table 21 suggest that an EFD with most of its work administered by large ROICC offices will be less costly than an EFD with most of its work administered by small ROICC offices. (the term costly is used here instead of efficiency as the differences between the size category of offices in terms of output per man year is largely a result of the differences in scale and not a result of the practices of the personnel in those offices. As such both large and small offices may be working at the same level of efficiency while the small operation is twice as costly). Table 22 shows the percentage of each EFD's workload administered in the three size categories of offices.

It is apparent from Table 22 that the Southern Division had over two thirds of its workload administered by large ROICC offices in FY 75 and the Northern Division had about one third of their workload in large offices. As small offices are twice as expensive as large ones this difference in the Northern and Southern Divisions should effect the differences in the costliness of their two operations.

Another significant factor is the number of contracts.It takes more people to administer more

TABLE 22 PERCENTAGE DISTRIBUTION OF EACH EFD's FY 75 WORKLOAD BY SIZE OF ROICC OFFICE.

(figures in parenthesis number of offices in category)

	Large ROICC	Medium ROICC	Small ROICC	Other	Total
NORTHERN	36.5 (2)	33.5 (4)	27.9 (9)	2.1	100% (15)
SOUTHERN	69.8 (6)	16.7 (3)	12.3 (7)	1.2	100% (16)
WESTERN	52.8 (3)	31.1 (8)	13.7 (8)	2.4	100% (19)
CHESAPEAKE	52.3 (2)	17.7 (3)	15.3 (5)	14.7	100% (10)
AVERAGE	55.3 (13)	24.6 (18)	15.6 (29)	4.5	100% (60)

SOURCE: WIP figures from CMS June 1975 reports

contracts even though the dollar volume remains the same, as certain administration tasks must be performed for all contracts regardless of their size. The problem in dealing with this variable is that it can only be considered in a three dimensional way since the two dimensional relationships of people to number of contracts and work in place to number of contracts have no correlation. This is so because some offices have a relatively large number of people and few contracts and others have relatively few people and relatively large number of small contracts. (See Appendices F, G, and H for a comparison of those figures for each office). As such the number of contracts is only meaningful when it can be compared simultaneously with WIP and man years expended.

However, it is possible to derive a meaningful two dimensional relationship between man years and number of contracts by reducing both figures to unit quantities. To do this the number of contracts was divided into the WIP for each office which yields the figure, average WIP per contract. To reduce man years to a unit quantity the man years expended by each ROICC office in FY 75 was divided by its work in place. The following discusses the derivation of the average WIP per contract figure and its validity.

B4.4.3 AVERAGE WORK IN PLACE PER CONTRACT

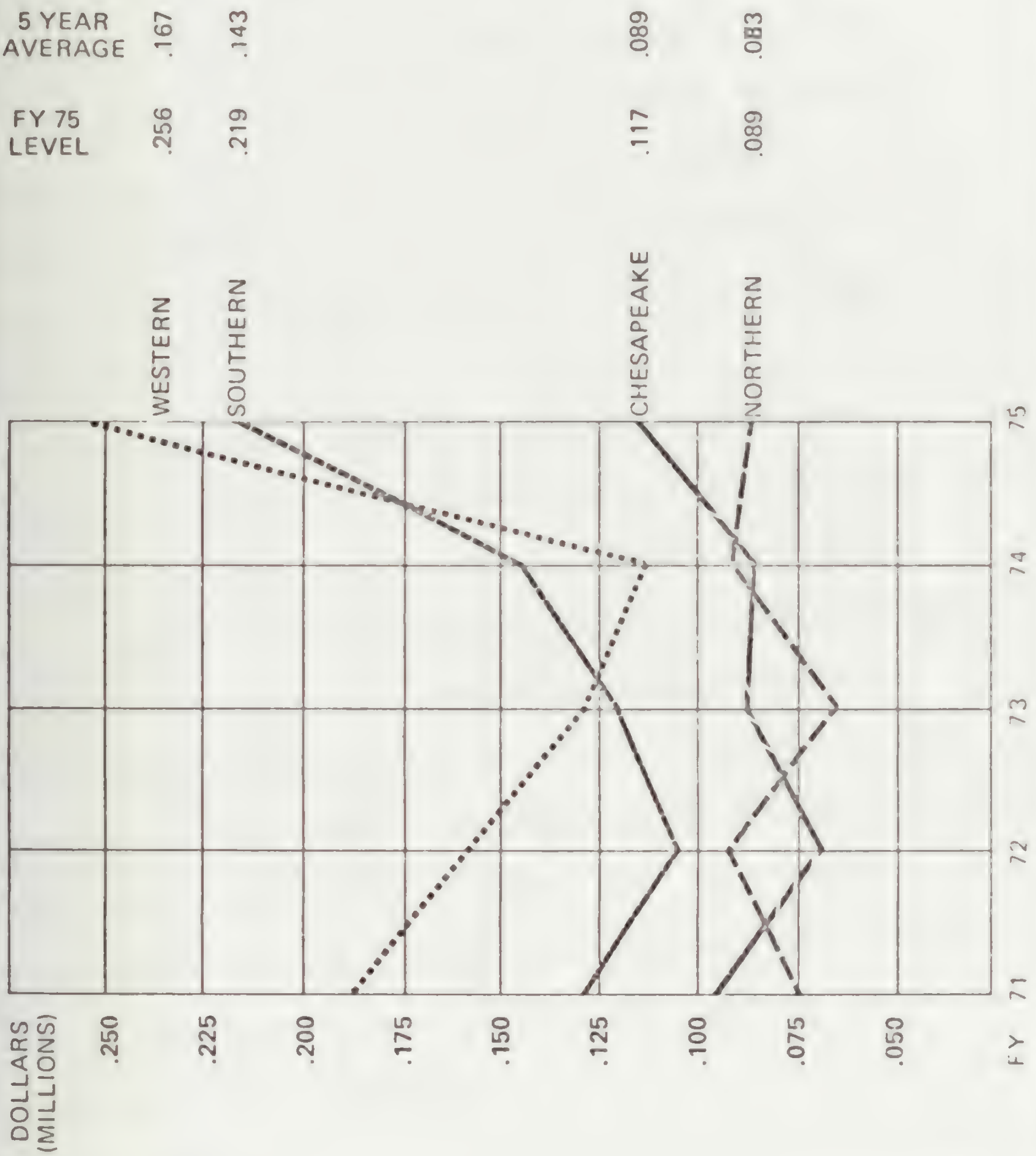
As explained in sub-chapter B1.4.2 a figure which matches the WIP produced in a fiscal year with the number of contracts that produced it is not available in the CMS, nor for the purpose of measuring workload would such a figure be any more meaningful than other figures which can be extracted from the system. The ROICC's work starts before a construction contract is ever awarded with reviewing the plans and specifications. He is called on during the bidding period to escort the bidders to the construction site and find answers to their questions concerning the plans and specifications. Immediately after the contract is awarded the ROICC office has a number of administrative tasks that must be performed. Because of mobilization time and long lead material and equipment deliveries it may be several months after the award of the contract before the contractor places any work. During this time there is normally very little work for the ROICC office.

At the other end of the contract the same problem occurs with some contracts remaining open without producing WIP for months waiting for events such as a claim settlement or completion of administrative requirements like the contractors submission of "as built" drawings. Again during this period there is normally very little work for the ROICC office. As a result the CMS does not attempt to compile the number of contracts administered in a given period. The only figure which is readily available from the system is the number of contracts "on the books" at a given point in time. The figures used were those "on the books" as of June 1975.

Figure 23 shows the average size of contracts for each EFD based on the number of contracts awarded during each of the fiscal years shown and the award amounts. These figures were taken from the Construction Summary Report which is submitted bi-annually. Although not matching WIP with the contracts that produced it they do match the number of contracts awarded with their initial contract value which can be thought of as WIP potential. Taking the total of the average size of contracts for FY 74 and FY 75

FIGURE 23

AVERAGE SIZE OF CONTRACTS AWARDED IN CONSTANT FY 71 DOLLARS
BASED ON THE NUMBER OF CONTRACTS AWARDED
DURING EACH OF THE FISCAL YEARS SHOWN AND THEIR AWARD AMOUNTS



SOURCE: Contract Summary Reports for the years shown, NAVFAC.

(a number of contracts active in FY 75 were awarded in FY 74) produces a set of figures which have relative differences very similar to the figures taken from the CMS, and as such suggest that the CMS figures provide a reasonable relative representation of contracts administered by the four EFDs during FY 75. A comparison of these two sets of figures is shown in Table 23.

As can be seen, Table 23 indicates that the number of contracts taken from the CMS is representative of the workload potential of the four EFDs.

B4.4.4 <u>ROICC OFFICE DEVIATION FROM AVERAGE STAFFING</u>

In order to weigh the differences between each EFD's workload/staffing levels considering the influence of the added variable average WIP per contract, this variable was graphed for each ROICC office against the man years the office expended per million dollars of work in place (Figure 24). A curve was mathematically derived to fit the 60 ROICC offices each represented by a point on the graph. (the equation for the curve is $\hat{Y} = .6404\ x^{(-0.4472)}$ where $\hat{Y}$ is the normalized man years and x is the average WIP per contract). The coefficient of correlation for this curve, (Figure 24) is .633. (The coefficient of correlation is a measure of the degree to which the two

TABLE 23 COMPARISON OF THE AVERAGE SIZE OF CONTRACTS FOR FY 74 AND FY 75 WITH FY 75 AVERAGE WIP PER CONTRACT

(first two columns in millions of dollars)

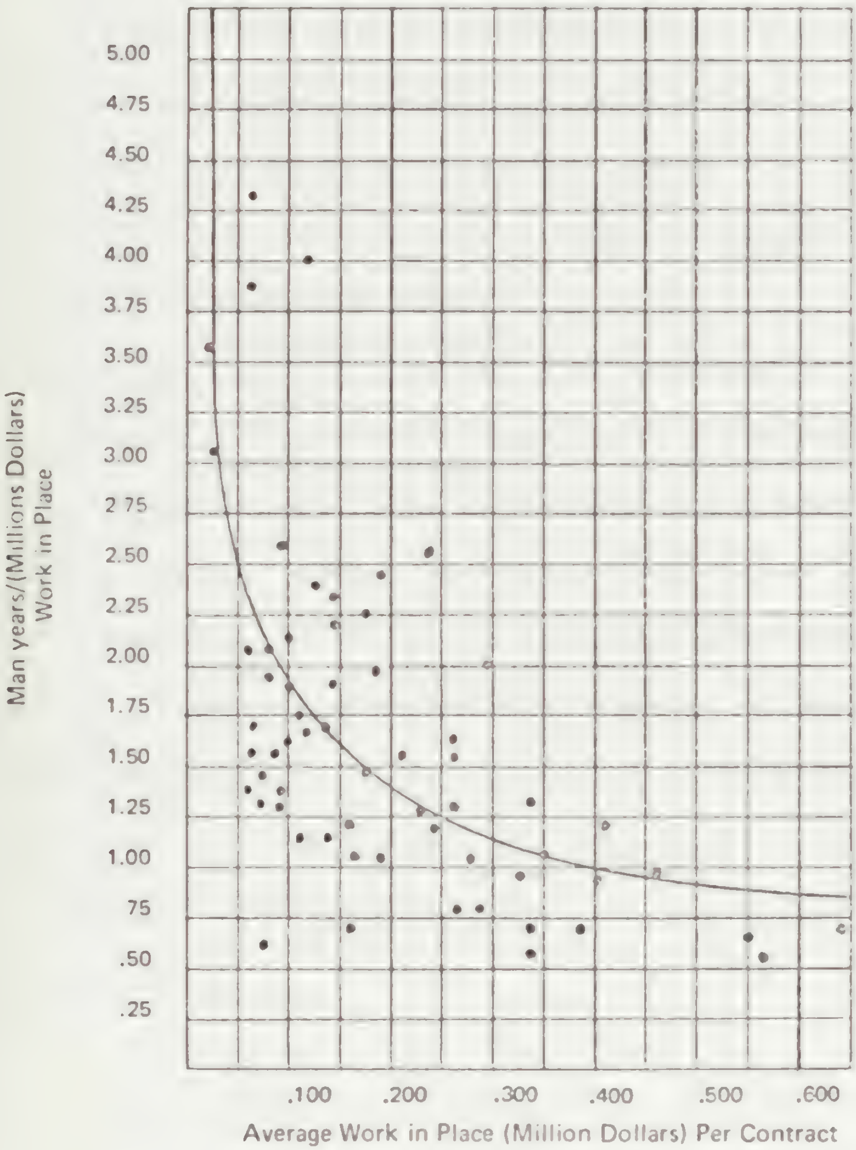
	Average size of contracts FY 74 & FY 75 combined (1)	FY 75 average WIP per contract (2)	Percent average size of contracts is of WIP per contract
NORTHERN	.180	.122	147.5
SOUTHERN	.362	.250	144.8
WESTERN	.368	.255	144.3
CHESAPEAKE	.204	.139	146.8

SOURCE: (1) Figures were taken from the Contract Summary Reports for FY 74 and FY 75, Figure 23.

(2) Both WIP and number of contracts taken from the CMS June 75 reports.

FIGURE 24

RELATIONSHIP OF THE FY 75 AVERAGE WORK IN PLACE PER CONTRACT FOR ALL ROICC OFFICES TO THE MAN YEARS EXPENDED PER MILLION DOLLARS
ALL OFFICES



SOURCE: WIP and number of contracts for each ROICC office from NAVFAC's Construction Management System, June 1975. Personnel figures from NAVFAC's Manpower Listing, 31 Dec. 1974.

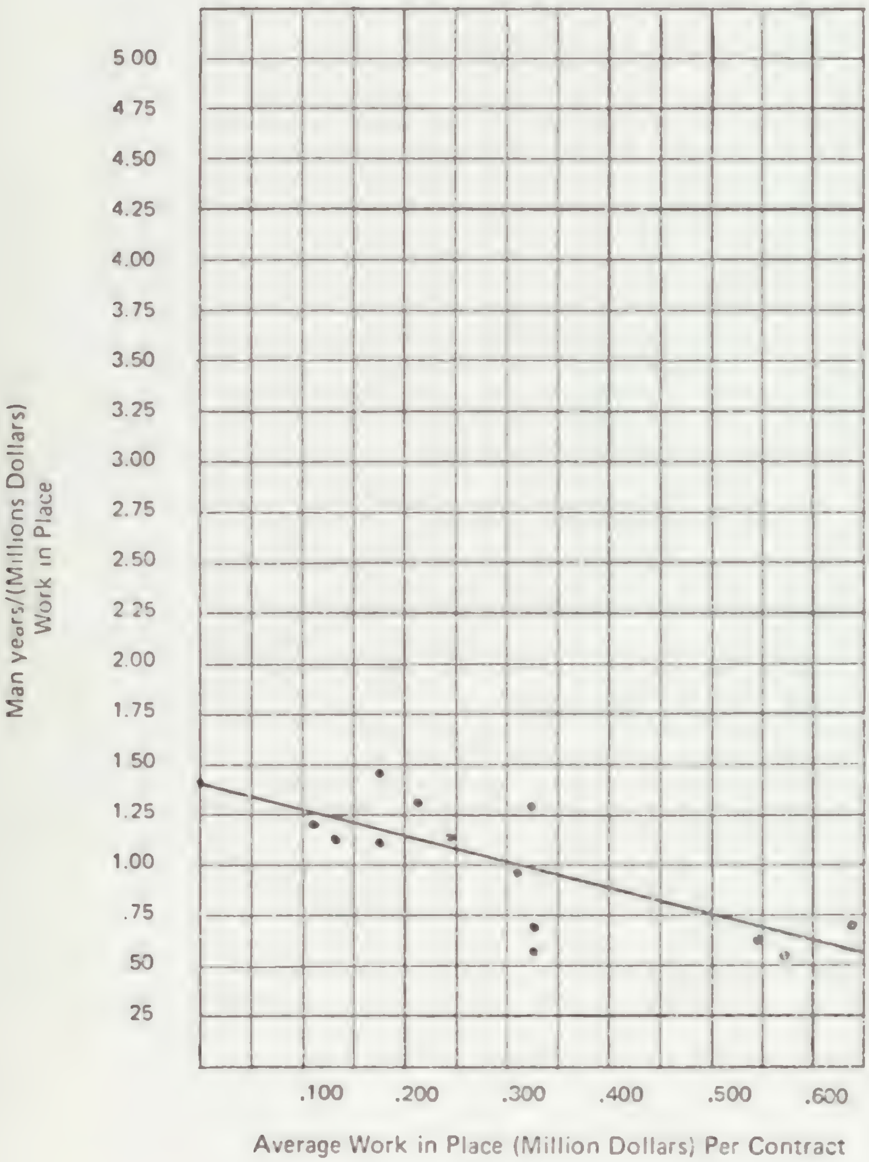
variables are related. A high correlation, that is all points falling on the curve or line would be 1, no correlation would be 0). The method of least squares (straight line) was also tried, which resulted in coefficient of correlation of .549, which indicates that the curve is a slightly better fit. Although the curve does not have a high correlation it does have a significant one.

The fact that more personnel are required as the number of contracts per unit of workload increases is intuitively verified. The fact that the coefficient was not higher simply means that there are other variables effecting the differences between workload and staffing. Perhaps the most significant of these other variables, the distribution of workload between size categories or offices, has already been demonstrated to have a significant effect on the workload/ staffing relationship.

Figures 25,26 and 27 show the relationship of the average WIP per contract to the unit of man years per million dollars WIP, for each of the three size categories of offices. Again both a power and curve and a straight line were mathematically derived for each graph. The coefficient of correlation for each method is as follows:

FIGURE 25

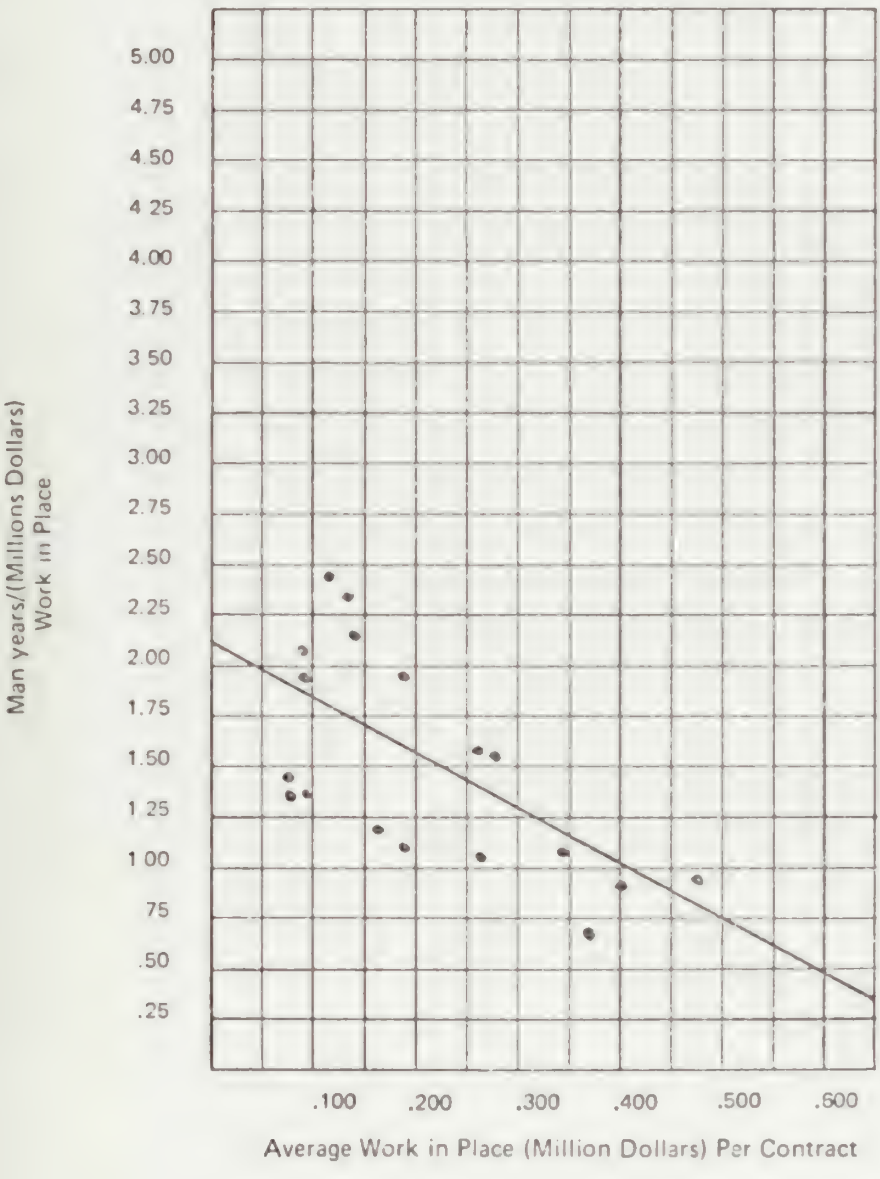
RELATIONSHIP OF THE FY 75 AVERAGE WORK IN PLACE PER CONTRACT FOR LARGE SIZED ROICC OFFICES TO THE MAN YEARS EXPENDED PER MILLION DOLLARS
LARGE OFFICES



SOURCE: WIP and number of contracts for each ROICC office from NAVFAC's Construction Management System, June 1975. Personnel figures from NAVFAC's Manpower Listing, 31 Dec. 1974. Line derived using method of least squares.

FIGURE 26

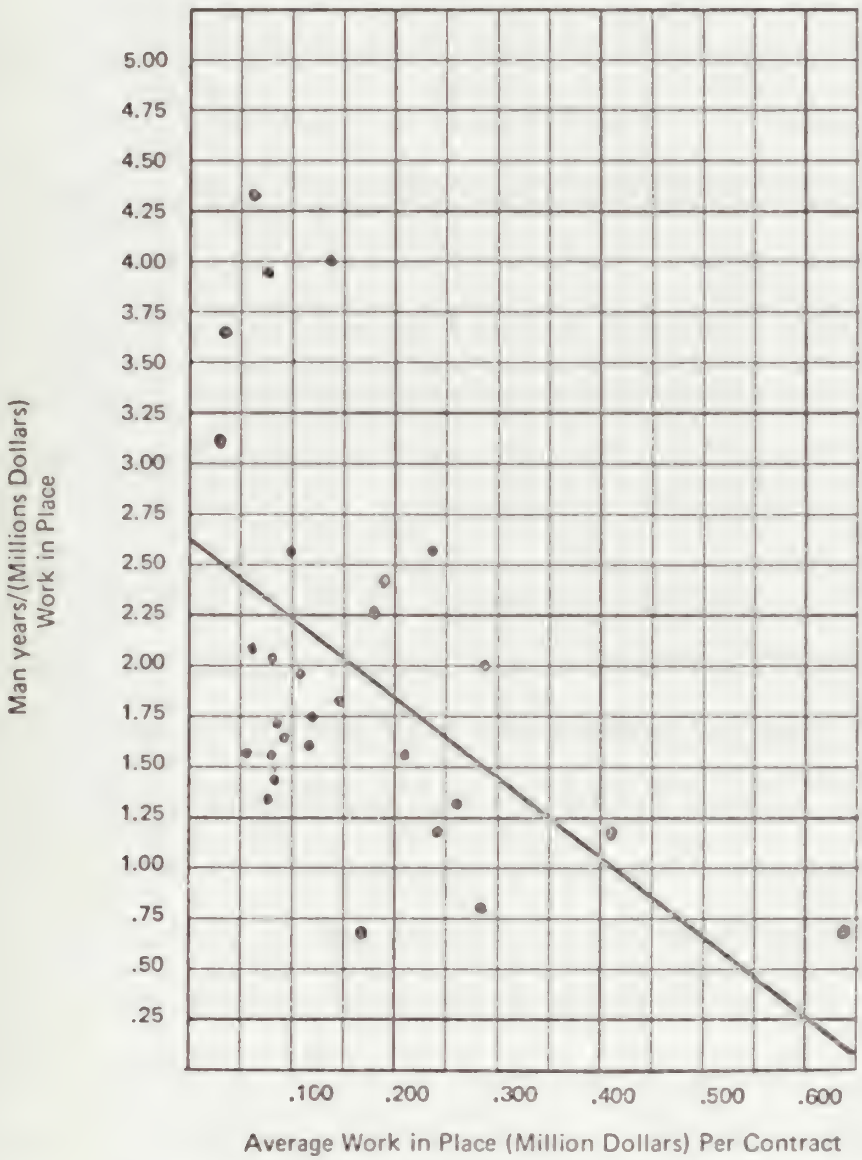
RELATIONSHIP OF THE FY 75 AVERAGE WORK IN PLACE PER CONTRACT FOR THE MEDIUM SIZED ROICC OFFICES TO THE MAN YEARS EXPENDED PER MILLION DOLLARS
MEDIUM OFFICES



SOURCE: WIP and number of contracts for each ROICC office from NAVFAC's Construction Management System, June 1975. Personnel figures from NAVFAC's Manpower Listing, 31 Dec. 1974. Line derived using method of least squares.

FIGURE 27

RELATIONSHIP OF THE FY 75 AVERAGE WORK IN PLACE PER CONTRACT FOR SMALL SIZED ROICC OFFICES TO MAN YEARS EXPENDED PER MILLION DOLLARS
SMALL OFFICES



SOURCE: WIP and number of contracts for each ROICC office from NAVFAC's Construction Management System, June 1975. Personnel figures from NAVFAC's Manpower Listing, 31 Dec. 1974. Line derived using method of least squares.

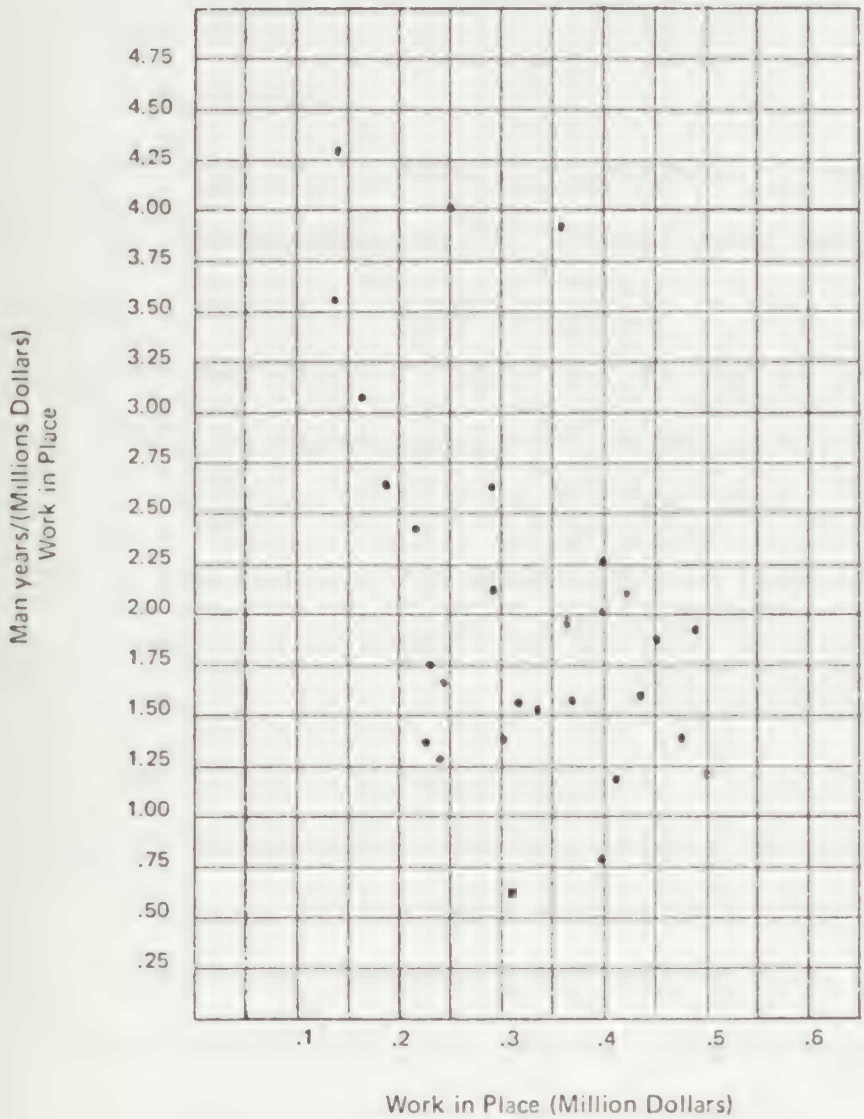
	Large Offices	Medium Offices	Small Offices
Power Curve	.761	.646	.392
Straight Line	.764	.659	.373

As could be expected the coefficient of correlation for the large offices is higher, where because of their size the difference in each contract tend to average out . On the other hand the small offices can be highly affected by just one or two large contracts.

Looking at Figure 27 it is noted that there is a tremendous variation in man years on the left hand side of the graph. (hence the lower correlation). In order to determine whether this resulted from a variation in office staffing or whether it was caused by the inefficiency of personnel in the small offices, WIP was plotted against man years per million dollars of workload. Figure 28 shows a definite decrease in efficiency as the workload decreases. It also shows tremendous variation in staffing for the same workload.

FIGURE 28

RELATIONSHIP OF FY 75 WORK IN PLACE
FOR SMALL ROICC OFFICES TO MAN YEARS EXPENDED
PER MILLION DOLLARS
SMALL OFFICES



SOURCE: WIP and number of contracts for each ROICC office from NAVFAC's Construction Management System, June 1975. Personnel figures from NAVFAC's Manpower Listing, 31 Dec. 1974.

In fact the variation in man years per unit for the same workload is as great or greater than the variation in man years per unit for the extremes in workload. This variation may be influenced by the fact that one man year makes up a large percentage of a small office's staff (as noted in Appendix H the number of personnel in the small ROICC offices vary from three to fourteen).

As can be seen from Figures 25, 26 and 27 the variable of office size significantly changes the slope of the line, where it took 1.3 man years to administer 1 million dollars worth of WIP when the average WIP per contract was .100 million dollars for a large office, it took 2.20 man years to administer the same work in a small office.

The problem with this two dimensional comparison is that in order to arrive at a normalized number of personnel that would have been required by each office if it had been staffed to the average (represented by the least squares line) the unit figure must be multiplied by another variable; work in place. This introduced an error in the calculation. Although the effect an office's WIP has on its staffing levels has been partly considered by dividing the offices into

three size categories there are still some differences within each size category.

In order to take this additional factor into consideration a multiple regression was performed for each of the three size categories.

The equation for this calculation is:

$$Z = a_o + a_1 x + a_2 Y$$

Where a_o, a_1 and a_2 are coefficients determined by the regression, Z is man years expended, x is WIP and y is number of contracts. The coefficients derived for the three size categories of offices are as follows:

	a_o	a_1	a_2
Large Offices	-1.29	.53	.11
Medium Offices	-1.49	1.03	.11
Small Offices	2.65	.73	.03

The coefficient of correlation for the three size categories of offices was calculated using the equation:

$$R = \sqrt{1 - \frac{\sum (z - \hat{z})^2}{\sum (z - \bar{z})^2}}$$

Where $\hat{z}$ is the redistributed number of man years and $\bar{z}$ equals the total number of personnel in each size category divided by the number of offices in that category. There is a question whether R or R^2 is a better measure to fit. Many authorities believe R^2 to be better. R was used here so the following coefficients could be compared with those calculated for the two dimensional regression where, (particularly for the method of least squares) R is considered to be the standard method for describing the degree of correlation.

	Large	Medium	Small
Multiple Regression	.897	.701	.346

As can be seen the coefficient is significantly higher than the method of least squares coefficient for the large and medium offices and slightly lower for the small offices.

Using the multiple regression equations the number of man years required, if each office had been staffed to the average (within each size category), was then determined. Table 24 shows the product of this calculation for each EFD and each size category of office. The figures do not total zero because of a rounding error(the

TABLE 24 REDISTRIBUTION OF ROICC PERSONNEL BY EFD AND SIZE CATEGORY OF ROICC OFFICE CONSIDERING THE VARIABLES WORK IN PLACE AND NUMBER OF CONTRACTS SIMULTANEOUSLY

	Man Years Expended	Redistributed Man Years	Deviation Over (under)	Precent Deviation Over (under)
NORTHERN	167	161	6	.4
SOUTHERN	180	223	(43)	(23.8)
WESTERN	269	219	50	18.6
CHESAPEAKE	97	112	(15)	(15.5)
TOTAL	713	715	(2) (A)	

DEVIATION OVER OR (UNDER) BY SIZE CATEGORY

	Large	Medium	Small
NORTHERN	3	(3)	6
SOUTHERN	(19)	(12)	(12)
WESTERN	15	21	14
CHESAPEAKE	(1)	(7)	(7)
TOTAL	(2) (A)	(1) (A)	1 (A)

SOURCE: See Section B4.4.4 for method of calculation.

Note (A) does not equal zero because of rounding error.

calculation resulted in fractions of man years which were rounded to whole man years).

Table 24 indicates that the Western Division was staffed significantly over the average during FY 75 while the Chesapeake and particularly the Southern Division were staffed significantly below the average considering WIP and number of contracts simultaneously. Where the difference between the personnel and WIP curves in Figures 19 to 22 showed the relationship of WIP and man years for each EFD, Table 24 shows the difference between EFDs and considers the additional variable, number of contracts. If this comparison reflects the differences in each EFD ability not only does each EFD need to be judged in relation to the peaks and valleys in their own workload but the differences in their average staffing levels needs to be considered when comparing EFDs. Unfortunately the figures for WIP and number of contracts were not readily available at the ROICC level for FY 71 through FY 74, so it was not possible to compute the five year average considering these variables. Without such an average it is impossible to tell how much the figures in Table 24 reflect basic differences in

staffing levels and how much their differences reflect the nature of their FY 75 workload. However, the differences are large enough so that they do suggest that significant differences in basic staffing levels exists.

B4.4.5 FUTURE WORKLOAD

Table 22 indicates that 55.3 percent of the workload during FY 75 was administered by large ROICC offices and 24.6 percent of the work was administered in medium sized offices. In order to determine how the projected future workload might effect this distribution among the two top size categories of ROICC offices, the projects in the MCON data bank were sorted by ROICC offices and EFD. Table 25 shows the workload for each EFD and size category of ROICC office from program year FY 72 through program year FY 78 and includes all of the projects in the data bank that had not been assigned to a program in August 1975. Although there are a few projects programmed out to FY 80, generally projects had not been programmed past FY 78. The projects that have been programmed have a greater certainty of being built than those that have not; therefore, Table 25

separates these projects from the total and provides the percent of the total they represent. It should be noted that when viewing the figures presented in Table 25 that MCON represents amount 53 percent of the total work in place. However, the other workload tends to vary more or less proportionally to the MCON workload.

As can be seen, generally, the big offices will stay big and the small offices will stay small. However, there are several medium sized offices and one small office that have significant future workloads. The offices which have a programmed workload of over 40 million, total 20 and include 11 of the 13 large offices, 8 of the 18 medium offices and one of the 29 small offices. These offices account for 71 percent of the total programmed workload. (Appendices F, G and H show these figures broken down by ROICC office.)

Referring back to Figure 17 which showed the location of ROICC offices it is noted that a number of ROICC offices are in the same geographical proximity. In order to determine what effect consolidating these ROICC offices would have on the workload distribution the following possible candidates for con-

TABLE 25 CURRENT AND FUTURE MCON WORKLOAD BASED ON THE BACKLOG OF MCON PROJECTS AS OF AUGUST 1975

	Total current & projected workload in the MCON Data Bank (millions of dollars)(A)	Total programmed (millions of dollars)	Percent programmed of total
NORTHERN	787.3	324.6	14.2
SOUTHERN	1,387.0	755.3	32.9
WESTERN	2,727.2	1,024.1	49.6
CHESAPEAKE	565.7	191.9	8.3
TOTAL FOUR EFDs	5,467.2	2,297.9	
LARGE	2,615.5	1,168.7	50.9
MEDIUM	1,410.8	549.0	23.9
SMALL	882.3	380.1	16.5
OTHER	486.6	200.1	8.7

NOTE: (A) All programmed projects from FY 72 through FY 80 and all unprogrammed projects in the data bank.

SOURCE: MCON Data Bank August 1975

solidation were considered; the three ROICC offices in the Philadelphia area, (East Pennsylvania, Philadelphia Area and Lakehurst), all the ROICC offices in the Chesapeake Division, the two small offices below Charleston (Beaufort and Parris Island), the two ROICCs in the New Orleans area, (Gulfport and New Orleans), Camp Pendleton and El Toro, the three ROICC offices in the San Francisco Bay area (San Francisco, Moffett Bay and North Bay) the three ROICC offices in the Seattle area (Bremerton, Seattle and Whidbey Island), and the two ROICCs in the Chicago area (Great Lakes and Glenview).

This potential consolidation resulted in adding only one office to the over 40 million dollar category, the Philadelphia area, and consolidating two offices that were already over 40 million dollars in the Chesapeake Division. However this does raise the programmed amount for offices with more than 40 million dollars programmed to 84.5 percent of the total. This suggests that over 8/10 of the workload during the next five years can be concentrated in one third of the ROICC offices.

B4.5 RESIDENT OFFICER IN CHARGE OF CONSTRUCTION, PERFORMANCE INDICATORS

B4.5.1 "MARKET SURVEY", FY 75

During the spring 1975, NAVFAC, through its EFDs conducted a "market survey". The "market survey" as NAVFAC refers to it, was sent to the Public Works Officers at major activities. Each of these Public Works Officers was asked to rate the value and the potential, separately, on scales of 1 to 9 for the major services provided by the EFD. There were a total of six questions in the Program IV portion of the questionnaire. Three of these questions were dealing with matters not pertinent to the Thesis. Of the remaining three, the ROICC is responsible for the subject matter dealt with in one and shares the responsibility with the EFD for the other two. The latter three service categories, which dealt with the services the ROICC influenced are:

(1) Quality of the day to day support provided by the ROICC.

(2) Timeliness of project completion.

(3) Quality of the end product.

The results of this "market survey", shown in the table below, are presented in terms of the percent of each service's rated value to its rated potential.

TABLE 26 RESULTS OF NAVFAC's 1975 "MARKET SURVEY" WHICH ARE APPLICABLE TO ROICC OPERATIONS

	Day to Day Service	Timely Completion	Satisfactory end product	Average
NORTHERN	96.4	71.6	85.9	84.6
SOUTHERN	83.9	84.3	84.5	84.2
WESTERN	90.0	85.5	79.5	85.0
CHESAPEAKE	91.3	74.3	74.7	80.1
AVERAGE	90.4	78.9	81.2	

SOURCE: Results of the survey were provided by the NAVFAC Policy Planning Officer.

Of particular significance is that the score has some correlation with the staffing differences discussed is sub-chapter B4.4.4. The Western Division, whose ROICC offices were staffed over the average with respect to their workload, in FY 75, had the highest score on the market survey and the Southern Division, which was staffed furthest below the average, had the lowest score of the first three EFDs. The Chesapeake Division's score can probably be explained by their high turnover and the fact they

were also staffed significantly below the average in FY 75.

The figures from the market survey suggest that the more resources and effort expended on each product the better the product, which is exactly what the figures discussed in sub-chapter B3.4.3.3 concerning design performance indicated. However the spread between 85.0 and 84.2 is extremely small, and the differences in the FY 75 staffing levels shown in Table 24 were relatively large.

B4.5.2 TIMELY COMPLETION

As previoulsy discussed (sub-chapter B2.5.1) one of the questions asked in the ROICC survey was "how many contracts during FY 75 were completed on or before the beneficial occupancy date (BOD) you furnished the customer." The ROICCs were arbitrarily divided into two groups, those ROICCs who met more than 50 percent of their promised BODs and those who met less than 50 percent. Twenty-five percent of the ROICCs responding to the survey fell in the first group and 75 percent in the latter group. The average of the BODs met in the first group was 63 percent and the range was 50-80 percent, while the average for the second group was 22 percent and the range 4-47 percent. Sixty percent of the first group was staffed at or over the average, where only 44 percent of the second group was staffed at or above the average. Those staffed below average in the group with high BODs met were understaffed by an average of 3 man years per office while those staffed below the average in the second group were understaffed by an average of 4 man years per office.

It is interesting to note that 28 percent of the small offices were in the group with high BODs met, 25 percent of the medium offices were in this

group and only 22 percent of the large offices. It appears that the small offices pay more attention to meeting the completion dates. The percent of ROICC offices falling in the group with high BODs met, by EFD were, Northern 45 percent, Southern 25 percent, Western 20 percent and Chesapeake 0. It is also interesting to note that although the group with high BODs met had fewer offices staffed below the average they still had 40 percent in this category yet they met more than half of their BODs, while 44 percent of the other group were staffed over the average and didn't. This further verifies the conclusion reached in sub-chapter B3.4.3.3 that goal performance is more a matter of commitment than resources. It is important to note when reviewing these figures, that although the completion of projects on or before the contract completion date was a goal for FY 75, it was not as vigorously pursued as the other goals, and in fact the reporting of this goal was dropped from the goal report about half way through the year, undoubtedly for the reasons discussed in sub-chapter B2.5.1.

B4.6 INSPECTION AND CONTRACT ADMINISTRATION PROCEDURES

B4.6.1 CURRENT USE OF INSPECTION PLANNING AND CONTRACT ENFORCEMENT

The group with the high percentage of BODs met and those who had a low percent of BODs met had similar

answers to many of the survey questions. The striking differences were in the use of inspection planning techniques, the use of checklists, the use of contract enforcement measures, and the percentage of their customers that attend final inspections.

The three questions concerning inspection planning and team inspection in the ROICC questionnaire were:

(1) Did your office develop formal written plans for Navy Surveillance/inspection on CQC contracts or for inspection on other contracts, during FY 75?" (The question was qualified by stating that a surveillance/inspection plan is one that includes, in detail, what will be inspected, how, when, and by whom.)

(2) Did your office use statistical methods or similar sampling/decision making techniques to optimize your inspection effort, during FY 75?

(3) Did you use team inspection procedures for other than final inspections on contracts administered by your office during FY 75?" (This question was also qualified by stating that team inspection

is the utilization of a group of specialists to perform indepth inspection at the critical points in a project's construction.)

Each of the questions had a series of qualified yes and no answers (see the questionnaire Appendix A). The answers which stated that the ROICC would use these procedures if he had an adequately trained staff, along with answers stating that the procedures were used, with at least limited success, were scored yes. All other answers were scored no. For the combination of these three questions the group with the high BODs met, scored 73 percent of their total responses "no" and only 27 percent "yes." The second group scored 47 percent of their total responses "no" and 53 percent "yes". Only 17 percent of the answers indicated that the planning procedures were currently being utilized and two thirds of these were for team inspection. The fact that the group with low BODs met used, or would use if they had the capability, identified inspection procedures much more frequently than the group with the high BODs met infers that the identified inspection procedures are not particularly related to the objective of meeting a BOD goal.

Although 73 percent of the first group marked "no", to the three questions concerning inspection planning, this group indicated that they used the procedures covered in the following two questions (which included developing checklists, a type of planning) more extensively than the group with low BODs met:

(1) On how many of your active contracts during FY 75 did you have personnel with the time to develop and utilize a checklist of all required submittals, tests, and shop drawings?

(2) On how many of your active contracts during FY 75 did you have personnel with the time to develop checklists or otherwise conduct a thorough check to insure that all maintenance manuals, warranties, certificates, as built drawings and other administrative contract requirements had been complied with before the final release?"

The average of the ROICCs in the first group had 49 percent and 74 percent of their projects in the two categories respectively, where the second group had only 40 percent and 60 percent of their projects in these same categories.

To determine the frequency of the use of the contract enforcement actions, the ROICCs were asked on how many of their active contracts during FY 75 did they employ the following enforcement actions to force contractor compliance:

(1) Removal and replacement of defective materials or workmanship.

(2) Withholding of payment.

(3) Removal of incompetent personnel.

(4) Stopping portions of the work due to defective performance/materials/equipment (excluding safety).

(5) Formally threaten termination.

(6) Termination.

The percent of positive response for each of the six enforcement actions was totaled for each ROICC (600 percent possible), and then averaged for each group. The average for the group with the high percentage of BODs met, was 68 percent and the average for the other group was only 35 percent. With regard to their effectiveness this may be the most significant difference between the two groups.

The other significant difference in the two groups

was the percentage of their final inspections that were attended by the customer. The group with the high BODs met stated that the customer attended final inspection on 80 percent of their projects where the customer attended the final inspections for only 62 percent of the projects in the second group.

As indicated by the responses, inspection planning and team inspection techniques are not generally being utilized. This confirms one of the initial hypothesis made in the letter forwarding the questionnaire. The fact that the techniques are not generally utilized may be a result of an intuitive recognition of their cost/benefit. As viewed by the Acquisition Department Head (sub-chapter B3.6) inadequate inspection caused less than five percent of the major problems experienced in the acquisition process. Of the problems at the ROICC level inadequate inspection would cause a larger percentage but it is the author's opinion, based on ROICC experience, that the percentage is still small and probably in the range of 10-15 percent. As the Navy inspector does not have the background to develop and monitor meaningful inspection plans this job would have to be accomplished by ROICC engineers. In light of the other problems that face the ROICC he may well not be able to afford

the engineering effort required to perform inspection planning where the maximum gain is only some improvement on the 15 percent of the problems he faces. In light of this reasoning the response of the group with high BODs met to the questions dealing with planning techniques make sense.

The fact that only 25 percent of the responding ROICCs fell in the group with high BODs met may be largely due to the fact that there was not a formal plan at the ROICC level during FY 75 which established this as a specific goal. The responses to the survey dealing with BODs met and other questions indicate that ROICCs utilize different procedures and suggests that ROICCs have different goals.

B4.6.2 THE NAVY INSPECTOR

The Navy's inspection of construction performed by contract has traditionally been carried out by the Navy Inspector. The title "Inspector" was changed a few years ago to Construction Representative for the higher inspector grades. However, the term "inspector" will continue to be used throughout the Thesis as it more accurately describes the major portion of the work involved. Table 27 shows the percentages responding ROICCs assigned to the distribution of their inspectors' work effort, sorted by EFD and size category of ROICC office.

TABLE 27 PERCENTAGE DISTRIBUTION OF INSPECTORS WORK EFFORT

(all figures are the average percent responding ROICCs assigned to each category)

	Labor Relations	Safety	Reviewing Contractor Reports	Coordination with station personnel	Resolving problems in the plans & specifications	Reviewing plans & specifica-tions	Paper Work	Other	Inspecting the work
NORTHERN	5	6	8	5	9	5	8	4	50
SOUTHERN	5	12	9	6	9	4	12	2	41
WESTERN	5	6	11	6	9	7	10	2	44
CHESAPEAKE	9	7	3	4	12	8	10	2	45
ALL RESPONDING ROICCs	6	8	8	6	9	6	10	2	45
LARGE	3	11	10	7	11	6	12	3	37
MEDIUM	6	8	8	6	10	6	10	2	44
SMALL	5	6	8	8	8	5	8	3	49

SOURCE: ROICC Questionnaire

The most striking trend is in the amount of the inspectors' time applied to "inspecting the work" for the three size categories of ROICC offices. The small offices are apparently applying 12 percent more of the inspectors' time to this task than the large offices. Conversely the larger offices apply more of their inspectors' time to safety, resolving problems in the plans and specifications, and paper work. Yet all three size categories of offices have nearly (within 3 percent) the same proportion of inspectors to total staff (see Table 19).

The major differences in the utilization of the inspectors' time between EFDs appears to be, at least partly, explained by the distribution of each EFD's workload among the three office sizes (see Table 22). The Southern Division has the largest percentage of its workload in large offices whose inspectors spend the least percent of their time inspecting the work, hence the Southern Division has the smallest percent of their inspector's effort applied to inspecting the work. The opposite is true for the Northern Division which has most of its workload in medium and small sized offices. This may also help to account for the fact that the Southern Division has the highest percentage of its inspectors' work effort applied to

safety and paper work.

A further insight into the use of the Navy inspector can be gained by looking at the differences in dependence the three size categories of offices have on the inspector for final inspections. The figures in Table 28 show the difference in the inspection procedures used on final inspections by the four EFDs and the three size categories of offices.

Of significance is the tremendous reliance the small offices have on their inspectors. The ROICCs in small offices also stated that their customers only attended 38 percent of their final inspections. Undoubtedly most of the inspections the customers attended were the larger projects, in which the ROICC or his staff engineers also attended. If this is true then the data suggests that the inspector probably had the full responsibility of accepting nearly half of the small offices' projects in FY 75. The medium sized offices depended on the inspector for just over a third of their final inspections and the customer attended 70 percent of the final inspections. Undoubtedly, the projects that the inspector performed the final inspection on were the smallest projects, which were probably among most of the 30 percent of the final inspections which the customer did not attend.

TABLE 28 PROCEDURES USED BY ROICC OFFICES FOR FINAL INSPECTIONS
(figures are the averaged percent of responding ROICCs projects in each category)

	Perform final inspections following a detailed plan or checklist	Perform final inspections following a general plan or checklist	Perform final inspections without a plan relying only on experience of staff engineers and inspectors	Perform final inspections without a plan relying only on the experience of inspectors
NORTHERN	11	18	24	47
SOUTHERN	7	13	67	13
WESTERN	3	11	52	34
CHESAPEAKE	5	28	43	24
ALL RESPONDING ROICCs	6	17	47	30
LARGE	10	24	61	5
MEDIUM	0	11	54	35
SMALL	10	17	31	42

SOURCE: ROICC Questionnaire.

The differences between the EFDs, in their reliance on inspectors to perform final inspections, seems to again be influenced by the distribution of their workload among the three size categories of offices, i.e., the Southern Division which has the most workload in large offices has the least reliance on its inspectors for final inspections.

B4.7 RESIDENT OFFICER IN CHARGE OF CONSTRUCTION, INVOLVEMENT IN THE DESIGN PROCESS

Currently ROICCs are only slightly more involved in the design process than the design engineer is involved in the construction process. Eighty-five percent of the ROICCs responding to the questionnaire did not participate, in the slate, selection or fee negotiation procedures for any of their contracts. Forty percent did not participate in any of the 30 percent design reviews, 27 participated in some of the 30 percent reviews and only 33 percent participated in 30 percent reviews for all major projects. Only 67 percent of the ROICCs responding to the survey attended 100 percent design review conferences on all major projects. (The 30 and 100 percent design reviews are normally held only for major projects).

With respect to the depth of the ROICC review of plans and specifications, 13 percent indicated that it was their policy to perform a thorough review, before the bidding stage, of all plans and specifications, including reviewing technical as well as functional items. Fifty

percent indicated it it was their policy to perform, before the bidding stage, a general review consisting of identifying repeated construction problems. It was the policy of the remaining 37 percent to perform, before the bidding stage, a thorough review on major projects and a general review on all others. (It is the stated policy of most EFDs that the ROICC should perform only a general review of plans and specifications).

These figures reflect the ROICC's stated policies. However, they were only able to meet these intentions on 55 percent of their projects. On an additional 15 percent of their projects they were not able to perform a review until the bidding stage, and on 22 percent of their projects they were not able to perform any review. The remaining 8 percent of the projects were reviewed before the bidding stage but were not reviewed to the desired depth. Overall the ROICCs responding to the questionnaire stated they were only provided plans and specifications by the EFD to perform reviews at the 30 percent design stage on only 20 percent of their projects. The responding ROICCs also stated that they performed a review at the site with plans and specifications in hand, on only 32 percent of their projects. Table 29 shows a breakdown of these figures by EFD and by size of ROICC office.

Of significance is the fact that the Western Division's

TABLE 29 LEVEL OF ROICC REVIEW OF PLANS AND SPECIFICATIONS

(all figures are the averaged percentage the responding ROICCs assigned to each category.)

	Desired Review Achieved (A)	Less than desired Review Achieved Before Bidding (A)	Reviewed During Bidding (A)	No Review (A)	Provided Plans for 30% Review by EFD	Performed review at site with plans and specifications in hand
NORTHERN	62	7	19	12	17	27
SOUTHERN	65	0	20	15	23	44
WESTERN	28	26	7	39	6	16
CHESAPEAKE	79	6	5	10	22	43
ALL RESPONDENTS	55	8	15	22	20	32
LARGE	49	7	13	31	23	41
MEDIUM	53	15	3	29	6	27
SMALL	62	2	30	6	28	29

(A) The first four columns total horizontally to 100 percent. The last two columns list the answers to independent questions.

SOURCE: ROICC Questionnaire.

ROICC offices reviewed significantly fewer designs yet they tied with the Northern Division having the lowest total DADS identified problems that were the responsibility of the Design Division (Table 10). This fact may be partly accounted for by the fact that the Western Division had next to the largest percentage of its Acquisition Department including ROICC office personnel in Design (Figure 13).

If this is true then the data indicates that the number of personnel in the Design Division has a greater influence on the quality of design than the ROICC review of plans and specifications. This conclusion seems quite logical.

Although the ROICC review of the plans and specifications may not be a major or even a significant factor in design quality it certainly affects the ROICC staff's knowledge of the project which can do nothing but assist the ROICC in performing his assigned tasks. It is also interesting to note from Table 29 that on the average the large offices review significantly fewer plans and specifications than do small offices. Considering the fact, noted in sub-chapter B4.5.2, that a greater percentage of small offices were in the group of high BODs met, the data suggests that small offices may give each project more attention. At the same time, however, ROICCs in the large offices did visit the job with plans and specifications

in hand on a greater percentage of their projects, than did those from small or medium sized offices.

SECTION C, SUMMARY AND RECOMMENDATIONS

CHAPTER 1 SUMMARY OF RESEARCH FINDINGS

C1.1 CHAPTER OVERVIEW

This chapter will restate the five hypotheses delineated in sub-chapter B1.1 and will summarize the research findings pertinent to each.

C1.2 LOSS OF COMMUNICATION BETWEEN DESIGN AND CONSTRUCTION

Hypothesis (1) There is a loss of valuable communication between the design and construction in the Navy's current building process.

To quantify the degree of communication that exists between the geographically and organizationally separated design and construction processes, ROICCs were asked a series of questions concerning their involvement in the design process and their communications with the Design Division and the A-E.

With respect to the ROICC involvement in the Design process sub-chapter B4.7 reported the following ROICC responses to the survey:

(1) Eighty five percent stated they did not participate on any of the slate, selection or fee negotiation boards.

(2) Only 33 percent stated that they attended 30 percent design conferences, for most

major projects and forty percent stated that they did not attend any of the 30 percent design review conferences.

(3) Only 67 percent stated they attended 100 percent design review conferences on most major projects. (The 30 and 100 percent design review conferences are normally held only on major projects.

(4) On the average the responding ROICC stated that they conducted reviews, on site with the plans and specifications in hand, on only 32 percent of the projects.

(5) On the average reporting ROICCs stated that they did not have the opportunity to perform any review on 22 percent of their projects.

(6) On the average responding ROICCs stated that they received 30 percent plans and specifications to review on only 20 percent of their projects.

With respect to the Design Division and the A-E's involvement during the construction process, subchapter B3.4.4 reported the following responses

to the ROICC survey.

(1) Design Division or A-E personnel visited during construction 7 percent of the EFD projects in FY 75 for the sole purpose of seeing how the design turned out, and another 16 percent for the purpose of solving specific design problems. Combining these figures the Design Division and A-E personnel only visited a total of only 23 percent of the EFDs' projects during FY 75.

(2) The A-E attended routine inspections on only 5 percent of the EFD projects during FY 75 and final inspections on only 1 percent of the EFD projects.

(3) Design Division personnel attended routine inspections on only 3 percent of the EFD projects during FY 75 and final inspection on less than 1 percent of the EFD projects.

Sub-chapter B3.5.2 presented evidence which suggested that the Construction Division's function of providing a coordinating and information gathering service has resulted in the Construction Division screening communications between the ROICC and the Design Division. Table 14 showed that 97 percent of the ROICC offices in the Northern, Southern and Western Divisions communicated with the

Construction Division frequently during FY 75 where only 12 percent communicated frequently with the Design Division during this same period. On the other hand only 25 percent of the ROICC offices communicated with the Chesapeake's Construction Division frequently and 75 percent of the Chesapeake Division's ROICC offices indicated that they communicated frequently with its Design Division. As the Chesapeake's Construction Division does not provide the problem coordination and information gathering service, the communication patterns between the Chesapeake Division and its ROICC offices suggest that if it were not for this service ROICCs in the other EFDs would be communicating more frequently with their Design Divisions. The practice of funneling communications between the ROICC and the Design Division through the Construction Division can only further widen the gap between the design and construction processes.

The above statistics demonstrate that the ROICC's involvement in the design process is minimal, and that the

design engineer's involvement in the construction process is even less. As such the ROICC does not have the opportunity to fully benefit from the design engineer's specific knowledge of the project. The design engineer makes thousands of decisions during the design process and in making these decisions he researches items such as the problems involved in the application of various wall coverings or he may think through the construction procedure involved in a particular construction joint. His research, which might result in the specifications of a wall covering which will be difficult to install or a joint that will require a high degree of workmanship in order to provide the desired finished appearance is frequently not communicated in the plans and specifications. As performance provisions are difficult to write so they do not include "gray areas" the ROICC is frequently in a position of having to accept marginal performance where if he had been aware of the potentially critical nature of the item he could have discussed it with the contractor, and reduced the probability of poor performance.

In a like manner the design engineer is only able to take minimal advantage of the ROICC's knowledge of site conditions, such as the availability and dependability of

record drawings for a particular site, or the ROICC's potential for viewing his customers' problems within the context of local conditions. In addition the ROICC, due to his geographical location, has the potential of developing a strong continuing relationship with the customer, from project to project, from which both the customer and NAVFAC could benefit. Currently the Engineer in Charge (EIC) is the major point of contact with the customer during the design phase. Normally EICs are assigned to projects on the basis of type of work involved and their background in this area. As a result there is little customer continuity from project to project. Although some project managers are assigned on a customer basis the project manager is only involved with the design portion of the process and spends less than 15 percent of his time on matters involved with the construction phase (Table 6).

The question of how much effect the present communication gap has on the performance characteristics of the end product has not been addressed, although the notion that a detrimental relationship exists has certainly been implied. It is felt that the Thesis, as a whole, presents sufficient evidence to support the need

for change without undertaking to prove that a direct relationship exists between the level of communications in the design and construction processes and the performance characteristics of the end product.

C1.3 PROJECT MANAGEMENT AS CURRENTLY PRACTICED

Hypothesis (2) The EFD project manager is not practicing project management in its full context.

The project manager's job as currently practiced is predominately concerned with design coordination. Table 6 showed that on the average the work effort of the project manager in the four Engineering Field Divisions is distributed in the following manner:

51% Design Coordination

15% Construction Coordination

20% Funding Matters

14% Obtaining and passing status information

It was reported in sub-chapter B3.3.3 that the Heads of the Project Management offices in the Southern, Western and Chesapeake Divisions stated that the responsibility for maintaining customer relations during the design phase was about equally split between the project manager and the Design Division's Engineer in Charge. The Head of the Project Management Office in the Northern Division stated that his project managers handled 70

percent of this coordination. The Acquisition Department Head for the Western Division stated (B3.4.2) that he had 120 EICs. The Western Division has 16 project managers (Table 5). If this ratio of 1 to 7.5 holds true for the other EFDs the EIC's involvement with the customer once design is underway may well be greater than it appeared to the Heads of the Project Management Offices.

Table 5 showed a tremendous spread in the estimated average number of projects per project manager for FY 75, which ranged from 29 in the Northern and Western Divisions to 49 in the Southern Division.

In practice the project managers are performing specified administrative and coordination tasks for the Acquisition Department Head and they are not practicing nor does their formal charter (B3.3.1) contain, the responsibility and authority to direct and manage projects through the design and construction processes.

C1.4 DESIGN AND CONSTRUCTION MANAGED AS SEPARATE PROGRAMS

Hypothesis (3) Design and construction are currently being functionally managed as separate continuing programs which has contributed to a focus on means rather than end product performance.

Figure 4 showed the geographical area assigned to each EFD. Figure 17 showed the locations of the ROICC office and the location of the main offices for the four EFDs. As can be seen the majority of the construction is geographically separated from the main offices of the Northern, Southern and Western Divisions. Only the Chesapeake Division is geographically situated where it can directly serve its customers.

Where the design and contract award processes are conducted at the EFD's main offices directly under the supervision of the Acquisition Department Head, the Acquisition Department is only responsible for providing technical guidance to the ROICC offices (Figure 5). Only 7 of the 60 ROICC offices in the four EFDs under study have full time ROICCs (sub-chapter B4.3) The other 53 offices have an additional duty ROICC, almost all of whom have primary duty as a public works officer in a completely separate chain of command. Because of the level of responsibility and other requirements of many public works officer billets it is not infrequent that the ROICC is senior in grade to the Acquisition Department Head, with the

the military system this would prohibit operational control from being exercised at the Acquisition Department level.

The primary coordination between the EFD and the ROICC office, at least for the Northern, Southern and Western Divisions is through the Construction Division who is primarily interested in functional matters, i.e., inspection procedures, personnel staffing and training, labor relations and safety. The only office that is in a position to provide management at the project level is the Project Management Office which spends less than 15 percent of its time on construction matters (as discussed).

As such the design and construction processes for the majority of the workload are both geographically and organizationally separated, and the products of both functional groups are largely managed as separate functional programs.

As discussed in sub-chapter B2.5 none of the FY 76 performance goals directly deal with the timely completion, cost or quality of the end product. The only FY 75 goal which dealt directly with the performance of the end product was a goal that measured the beneficial occupancy date (BOD) of the completed construction

project with the contract completion date (CCD). However, this goal was not vigorously pursued, apparently because it was recognized that the contract completion date does not provide for inevitable contingencies (the CCD is not an estimate of when the job will be done but a legal contract requirement that can be and is, frequently changed by change orders). The measurement of the CCD against the BOD is not necessarily a measure of when the project was completed relative to when it was promised to the customer (which is what is important). To determine how well promised occupancy dates were currently being met the survey asked several questions in this subject. The ROICCs responding to the survey stated that they completed only 33 percent (Table 2) of the projects they completed in FY 75 on or before the initial date they promised the customer. Further the ROICCs stated that the dates (Table 3) they provided their customers were based on their own estimates of completion (which were different than the CCD) for only 26 percent of their projects. On 67 percent of their projects the promised occupancy date was simply the CCD completion date. (The promised occupancy dates for the other 7 percent were provided by the EFD).

It is safe to assume that the percentage of projects that were completed on or before the date promised the customers at the beginning of the design was less (probably significantly less) than the percentage of promises the ROICCs met. There definitely is a need to improve the number of project completion commitments that are met.

Three of the FY 76 goals deal with different aspects of projects' costs, but not one directly addresses keeping the final project costs within specified limits of the original estimate developed at completion of the 30 percent design, and subsequently submitted to Congress as part of the Military Construction Program (B2.5.2). Although there are precise limits imposed by Congress within which project costs must be managed (forcing the EFDs to track such costs), certainly the formal monitoring of how well these limits are being met, as one of the NAVFAC goals, is of equal if not greater importance than the monitoring of design costs (which must also stay within Congressionally prescribed limits). Costs for design are controlled by the goal which states that design costs should not exceed a cumulative cost of 2.5 percent of the construction cost estimate for con-

ventional family housing projects and 5.0 percent of the authorized amount for MCON projects (the goal for FY 75 was the same except that it included an additional 1 percent for program cost estimates along with a requirement that they be made, see A 2.3.2). The goal that addresses keeping construction cost estimates within 5 percent of the amount of the lowest responsible bidder, controls A-E cost estimating. (This is a new goal for FY 76). The third element of project cost is addressed in the goal which sets the upper limit for change orders at 3 percent of the initial contract amount (this goal was 5 percent in FY 75).

The need to measure end product performance was recognized in the FY 76 goals which provided for the development of a post-construction appraisal system. Sub-chapter B2.5.3 quoted from an article by John Steward which said that for such a system to be successful, it should be comprised of three activities, defining performance criteria, expressing the project objective in terms of quality standards, and monitoring progress toward these standards. As such the system becomes a management tool to assist in obtaining desired objectives rather than just a measure of the

end product which can only identify what should have been done. However such a system faces the same problem that other goals dealing with the end product face. With the current split in responsibility for the design and construction processes accountablity for the entire project does not exist at a low enough level to be meaningful,and accountability is an essential element of the management by objectives concept. This may explain part of the reason why the FY 76 goals primarily deal with the elements of the total process, the means, rather than the timely delivery, cost and quality of the end product.

In addition to not focusing effort on the end product, there is evidence that several of the goals dealing with means may not directly support end product performance.

Table 11 indicated that the Program III goal which requires that 25 percent of the available in-house engineering effort be applied to the design of major projects and the goal which requires early award of the construction contract, and its pre-requisite early design completion, may contribute to a reduction in design quality, as both goals reduce the available time the Design Division and the A-E

have to be spent on each project.

The discussion in sub-chapter B3.4 showed that the Southern Division had achieved the highest goal performance with respect to the goals relating to design. The data presented in Table 10 suggests that the Southern Division had the lowest quality of design during FY 75. The apparent reason for this lower quality of design (Table 11) was that the Southern Division had a smaller percent of their Acquisition Department including ROICC office personnel in design, a peak in workload during FY 75, (Figure 8) the highest percent achievement of the Program III goal requiring that 25 percent of available manpower in design be utilized "on the boards", and the highest percentage of their FY 74 program under construction contract on 30 June 1975. In addition, Table 13 pointed out that the Southern Division had the lowest percentage of design costs, and Table 12 pointed out that the Southern Division's A-Es and Design Division personnel visited the construction site fewer times during construction than did the other EFD's A-Es or Design Division personnel. In short,

high goal performance does not necessarily mean high product performance.

Table 4 showed the percentage of change order costs to initial contract values for FY 75, to be over 7 percent for MCON projects and over 6 percent for all fund sources. The figures showed relatively small differences between the percents for the Northern, Southern and Western Divisions. This tight grouping suggests that the FY 76 goal of keeping change orders within 3 percent will be difficult to achieve and might result in inhibiting necessary changes.

Although all of FY 76 goals have long range benefits such as improving in-house design capability by requiring that 25 percent of the engineering manpower in the Design Division be spent "on the boards," these long range benefits have short term costs. Whether or not the long range benefits offset the short term losses is another question, one which is beyond the scope of this Thesis.

C1.5 PROJECT AND WORKLOAD UNIQUENESS

Hypothesis (4). The current management system does not directly recognize the unique requirements of each project, nor does it recognize the unique character of each EFD workload and as such both the

commitment and capability to achieve uniform goals vary.

The only goal which is based on the examination of the individual projects making up each EFD's workload is the goal for WIP. This goal is derived individually by each EFD, and is largely based on the requirements of each project.

The other goals for FY 76, described in subchapter B2.2.2, were established across the board for all EFDs, based on overall program objectives. Like WIP design time and cost are unique to each project as well as the supervision, inspection and overhead (SIOH) expense need to administer them. Although with the size of each EFD's program some of the differences may average out there is no assurance that this is the case and in fact there is evidence presented in this Thesis which indicates that the differences in the EFD's workload may be significant. In addition to the inequities which may result from the uniform goals this system is not taking advantage of one of the basic principles of the management by objective concept. Among several quotations of noted authorities on the subject, presented in subchapter B2.3 are:

> "people support what they help to create."
>
> "tell'em their objectives...This technique removes a manager's motivation and commitment to carry out his objectives. . ."
>
> "...unless both parties feel that the objective is important, challenging and achievable, even cooperative activity will become only a meaningless exercise."

Sub-chapter B.2.3 also pointed out that:

> "There is evidence that where there is commitment throughout the organization the goals tend to be higher and the rate of achievement toward them also tends to be higher than where people are asked to respond to goals set from above without having the opportunity to influence them."

Sub-chapter B3.4, through a series of tables and discussion concerning design performance and staffing levels, indicated that there was a significant variation in EFD goal performance that could not be accounted for by the difference in their resources. These differences suggest that the level of commitment to achieve the NAVFAC goals varies between EFDs. If, as the literature suggests, goals and commitment tend to be higher when the personnel who are going to perform the task have an opportunity to participate in the goal setting process then the argument for using this process is strong. The variance in EFD commitment was further evidenced by the Acquisition Department Head's responses to the question

"What effect do the annual goals have on the way you do business with respect to local priorities?" There were four choices given. One Department Head chose the top choice, "the major force" two chose the second choice "one of the major forces" and the fourth Department Head chose the third choice "a significant effect."

The current uniform goals imply that each of the EFDs has a similar capability.

Although it is the intent of the Command Management System to reach a "negotiated contract" between the EFD and Headquarters wherein Headquarters will properly fund the effort and the EFD will properly execute the task there is convincing evidence that during FY 75 the EFD's Acquisition Department and ROICC office capabilities, with respect to workload varied significantly. Figure 8 showed WIP in constant FY 71 dollars for each of the EFDs over the last 5 years. The graph indicated that each EFD's workload had peaks and valleys during this period and that not all of these peaks and valleys coincided. It is only reasonable to staff and EFD to the level of its average workload. Figures 19 through 22 showed the relationship of workload and personnel for each of the EFDs over the last

five years. These figures indicate that the extent of the gap between workload and personnel varied significantly between EFDs. Even though the gap could be narrowed using overtime the differences are such that there would still be significant differences in capability.

Sub-chapter B4.4 compared the effects of the variation in the size of the ROICC officers (in terms of WIP) with respect to its effect on productivity in terms of man years expended. This analysis showed that a large ROICC office on the average, had twice the WIP per man year of a small office (Table 21) and as such an EFD like the Southern Division who has most of their work in the large offices (Table 22) should have a less costly operation. Another significant variable is number of contracts, which must be considered together with work in place to be meaningful. Considering these two variables simultaneously for each of the three size categories, along with the third variable, number of man years expended, ROICC personnel were redistributed so that each office had a comparable number of personnel considering their WIP and their number of contracts.

Based on this redistribution the staffing for each EFD's ROICC offices above or below

the average was calculated and the differences were displayed in Table 24. These figures showed a significant difference in each EFD relative capabilities. Table 26 showed the results of the FY 75 market survey which were consistent with the relative staffing levels (except for the Chesapeake Division) in that the score on the market survey was higher when an EFD had more ROICC personnel with respect to workload.

In summary there appears to be a significant difference in each EFD commitment to meet goals, which the literature suggests could be improved by the use of a cooperative goal setting process. Further it appears that there are significant differences in each EFD's capabilities and that these differences are apparently the result of not fully recognizing the unique character of each EFD's workload. Although an effort should certainly be made to attempt to equalize average capability the nature of each EFD's program from year to year as well as the peaks and valleys in workload will always produce differences, which should be considered in the goal setting process.

C1.6 MANAGEMENT, THE MAJOR PROBLEM

Hypothesis (5). The major problems faced in the design and construction portions of the building process

are managerial not technical.

Sub-chapter B3.6 combined data from the Deficiency Analysis System and the ROICC Questionnaire with the overview of acquisition problems viewed by Acquisition Department Heads. This discussion classified the problems experienced during construction as management and technical from the point of view of how these problems could be solved. The problems classified as solvable by management action outside the control of the Design Division were, lack of full understanding of customer needs, lack of adequate site investigation, and lack of full understanding of construction practices. Only "other aspects of poor design" was classed as a technical problem and within the realm of responsibility of the Design Division. As stated in sub-chapter B3.4.3.2, the first of the management problems can only practically be solved by developing closer working relations between the EFD and the customer. The second can be solved by directing the A-E to perform a more thorough site investigation (Requiring more design time and money). The third requires improving the feedback from the field so that A-Es with a poor understanding of construction practices can be weeded out in the selection process.

In a like manner the problems under cognizance

of the ROICC which were identified by the Acquisition Heads were classified as technical and managerial. The ROICC problems (B3.6) identified as technical were inadequate inspection and poor contract administration procedures. The problems classified as managerial were poor customer coordination/relations and poor contractor relations . (Table 17)

These technical and managerial problems were then fit into the context of major problems experienced in the acquisition process as seen by the Acquisition Department Heads. These major problems were identified (Table 16) as problems under the ROICC's control, problems in the plans and specifications, customer relations and "other."

Combining the managerial components of the problems under the ROICC's control and those in the plans and specifications, with the overall problem, "customer relations," gives a total of 61 percent for the managerial component of the overall problems as seen by the Acquisition Department Head. The technical problems under the control of the Design Division were 7 percent and those under the technical control of the ROICC represented 10 percent of the major problems in the overall context. The remaining 22 percent

fell in the category "other." (Table 18)

Although the data from which the above conclusions were drawn is rough the order of magnitude clearly states that, by far, the greatest problems facing the Acquisition Department are managerial and not technical.

SECTION C, SUMMARY AND RECOMMENDATIONS

CHAPTER 2. A CASE FOR PROJECT MANAGEMENT

C2.1 CHAPTER OVERVIEW

The problems presented in Chapter C1 are not unusual for a functional organization involved in producing a product that requires the continuous coordination of its functional elements. In fact, management literature indicates that these problems are quite common. This chapter will discuss the differences in a functional and product organization, define "project management" and show how this organizational form has been adapted in industry to solve problems similar to those experienced by NAVFAC.

After defining project management, a model of how this concept might be adapted to the NAVFAC environment will be presented and followed by a qualitative discussion of its potential impact on the EFD organization. The project manager will then be placed geographically and organizationally and the literature will again be brought to bear on the question of the project manager's qualifications. The chapter will conclude with an "order of magnitude" discussion of the number of project managers the proposed model

would require and a discussion of some techniques the literature suggests are necessary to make the project manager concept work effectively.

C2.2. FUNCTIONAL VS. PRODUCT MANAGEMENT

In the early part of this century a number of large companies went through an organizational transition from the traditional functional organization to a product orientated structure. The Dupont Company was one of the pioneers in this change, adopting an autonomous multifunctional division structure in 1921[18] which has served the company since. This change was made because the company had been unable to provide effective coordination between purchasing, production, and sales on their expanding product lines.

Since the 1920's many large corporations have adopted the product orientated divisional structure. Although this structure has proven highly successful on a large scale there are some questions about its effectiveness when used on a smaller scale. The literature suggest that when used on too small a scale its advantages may be outweighed by the advantages of a functional organization.

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18. Alfred D. Chandler, Jr., STRATEGY AND STRUCTURE p.112

One of the major advantages of a functional organization is that it permits the hiring of specialized personnel and allows for the pooling of their specialized resources, sharing them among several products. In addition, a functional organization can provide the career paths needed to maintain and further develop specialized personnel, whereas the product organization particularly one on a small scale cannot. Where specialized capabilities are needed, such as in the development of high technology products, the functional organizations may be desirable.

On the other hand the product organization "... facilitates coordination among specialists to achieve on-time completion and to meet budget targets. It allows a quick reaction capability to tackle problems that develop in one speciality, thereby reducing the impact of the other specialities"(19)

"The problem is that when one basis of organization is chosen, the benefits of the others are surrendered. If the functional structure is adopted, the techniques are developed but the project falls behind sche-

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19. Jay R. Galbraith, "Matrix Organization Designs," BUSINESS HORIZONS, February 1971, P-30

dule. If the project organization is chosen, there is better cost and schedule performance but the techniques are not developed as well." (20)

The problems experienced in the Navy's execution of their design and construction processes discussed in the Thesis are the same class of problems attributed to a functional organization. Considering the need for in-house specialists to handle the many technically complex "state of the art" facilities which make up a small but vitally important part of each year's building program and considering the large fluctuations in the size and make-up of workload from one year to the next, a product organization would have to continually adjust the number and mix of its personnel. Accordingly, one can understand why NAVFAC has chosen to tolerate the problems of a functional organization in return for its benefits.

However, the choice between a functional and a product organization does not need to be made in order to achieve the advantages of both. A form of organization which Jay Galbraith (21) describes as a "Matrix Organization", had its beginnings in the aerospace industry in the late 1960s. Since the 1960s this type

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20. Galbraith, Op. Cit., p. 30
21. Galbraith, Ibid

of organization has successfully been used in a number of different types of enterprises including construction companies and A-E firms. Matrix organizations include a combination of functional and product influences in varying degress and as such can be thought of as a continuum of influences between the pure functional and the pure product organizations.

The term "project management" is applied to the matrix type organization when the product is unique in nature and has a defined life such as the products produced in the research and development and construction industries. Where the outputs are identical or highly similar the term "product management" is used. As the term "Project Management" is more appropriate to NAVFAC's building process it will be used here.

Accepting the definition of a matrix organization as including a continuum of influences between the purely functional and the purely product organizations, the EFD's current project manager would fall close to the functional end of the scale.

What is being proposed here is moving across the scale toward the product end. This would involve taking personnel out of their functional organization either part-time or full-time to form a team under the direction of the project manager. Although these personnel would remain assigned to the team for the duration of the project they would only work on the project when needed, (working in their functional organization when not needed) and would return in full, to the functional organization when the project was completed.

David I. Cleveland delineates what he feels are the necessary characteristics for a successful project management organization:

> 1. "The charter of the project manager should be broad enough to enable his active participation in major managerial and technical activities. He should be given sufficient policy-making authority to integrate the functional contributions to the project goals.
>
> 2. The project manager must have the necessary executive rank to insure responsiveness in the parent company to his requirements and acceptance as its unquestioned agent in dealing with contractors and others.
>
> 3. His staff should be qualified to provide personnel administrative and technical support. He should have sufficient authority to increase or decrease his staff as necessary throughout the life of the project. His authorization

should include selective augmentation for varying periods of time from the supporting functional agencies.

4. He should participate in making technical engineering and functional decisions within the bounds of his project.

5. The project manager must have sufficient authority and capability to control funds, budgeting, and scheduling for the project." (22)

In order to discuss how a project manager, possessing similar authority, would fit into an EFD it is necessary to identify specifically what functions he should perform.

C2.3 THE MODEL

Table 30 provides a list of specific key functions that the project manager should perform based on the criteria discussed and the problems in the current design and construction processes defined in Section B of the Thesis. It is only intended that this list of functions be a "first cut" in order to allow a general assessment of what the concept entails. In order to show the impact on the existing organization, the organizational element currently performing each task will be identified. In addition an estimate of the relative effort each element is currently applying to the task and an estimate of the relative effort the proposed project manager should apply will be shown.

22. David I. Cleveland, "Why Project Management," BUSINESS HORIZONS, Winter, 1964.

TABLE 30. RECOMMENDED KEY PROJECT MANAGER TASKS

Number of Task	Description of Task	Performed By (A)	Current Relative Effort (B)	Proposed Relative Effort (B)
1	Consult with the customer and write the performance portion of the A-E scope of work once the preliminary design is authorized	PM DD	4	6
2	Participate on the slate and selection boards and conduct fee negotiations	PM DD	4 4	4
3	Take responsibility to insure that an explicit agreement on precise performance criteria is reached during the preliminary design conferences	PM DD	3 4	5
4	Take responsibility to insure that the A-E or in-house designer has all the information concerning local procedures and regulations he needs from the customer and/or the station, such as record drawings, and insure that an adequate site investigation is performed	PM DD	 1	2
5	Act as the central point of contact for the customer throughout the project including keeping him informed of progress on a regular basis	PM DD	3 3	6

Number of Tasks	Description of Task	Performed By(A)	Current Relative Effort(B)	Proposed Relative Effort(B)
6	Act as the central point of contact for inquiries concerning the project from above including preparing status reports	PM DD R	4 4 4	9
7	Take responsibility to insure that the customer fully understands the performance aspects of the design at preliminary and 30 percent review conferences	PM DD	2 5	8
8	Take responsibility to insure that the Design Division adequately reviews the design	PM DD	 2	2
9	Take responsibility to insure, at the 30 percent design stage, that any long lead material items are identified and where appropriate initiate action to procure long lead material or equipment	PM DD	 1	2
10	Take responsibility to approve all A-E payment requests and negotiate all change orders	PM DD	2 4	4
11	Take responsibility to insure that an adequate review of the plans and specifications is conducted at the construction site	PM CD	 1	2

Number of Task	Description of Task	Performed By(A)	Current Relative Effort(B)	Proposed Relative Effort(B)
12	Take responsibility to monitor the A-E's progress on both time and construction costs and take whatever action is appropriate when the A-E falls behind or it appears that the completed project will run overtime or cost	PM DD	5 5	7
13	Take responsibility to insure that an adequate 100 percent review is performed by the Design Division and "inspection office", and insure that theA-E has complied with the requirements of his contract	PM DD	 2	2
14	Take responsibility to oversee the advertising and bidding process to insure that all discrepancies in the plans and specifications are taken care of by addendum or otherwise handled	PM CO R	 2 2	4
15	Take responsibility to direct any redesign that is necessitated as a result of bids that were too high	PM DD	2 2	4
16	Take responsibility to conduct the pre-construction conference and insure that the contractor understands the requirements of the job as well as the procedural requirements of doing business with the Navy	PM R	 4	4

Number of Task	Description of Task	Performed By (A)	Current Relative Effort(B)	Proposed Relative Effort(B)
17	Take responsibility for insuring that the contractor mobilizes and starts work in a timely and orderly fashion	PM		4
		R	4	
18	Take responsibility to insure that inspection forces are assigned to the project and that they perform the planning necessary to adequately inspect the work	PM		4
		R	2	
19	Take responsibility to track the contractor's progress and take whatever action is necessary to insure his continuing productive effort	PM		7
		R	7	
20	Participate in all critical inspections and take responsibility to insure that the completed product is built in accordance with the plans and specifications	PM		8
		R	8	
21	Take responsibility to approve all requests for payment and negotiate all changes to the contract	PM		7
		R	7	
		CD	2	
22	Take responsibility to insure that the Design Division solves, either themselves or through the A-E, any design problems discovered during the construction process	PM		8
		R	8	
		CD	3	

Number of Task	Description of Task	Performed By (A)	Current Relative Effort (B)	Proposed Relative Effort (B)
23	Take responsibility to monitor costs throughout the contract to insure that the finished product will be completed within the budget	PM	6	6
24	Take responsibility to insure that the final inspection is properly planned, executed and that all aspects of the project meet the plans and specifications before the facility is accepted	PM R	 5	7
25	Participate in the post-construction evaluation and insure that the A-E and the construction contractors take whatever action is necessary to correct any items resulting from this evaluation or from other sources	PM R	 2	6
26	Perform a complete evaluation of the performance of the A-E and the construction contractor	PM R DD	 1 1	2
27	Perform an evaluation of the EIC and the inspector	PM		2
Subtotal	Project Manager Design Division ROTCC Construction Division Contract Division	PM DD R CD CO	31 42 54 6 2	132
Total			135	132

Note: A. Abbreviations defined above.

B. Relative effort is assigned on the basis of the author's experience in the U.S. Navy's design and construction processes and the experience gained in the preparation of this Thesis.

Source: Derived by Author

C2.4 IMPACT OF THE MODEL ON THE CURRENT ORGANIZATION

C2.4.1 PROJECT MANAGEMENT

The proposed model would completely replace the present project manager. However, the proposed project manager will not assume all of two functions which Table 6 identifies as taking 34 percent of the current project manager's time. The effort involved in coordination and tracking funding matters dealing with program concerns, and the effort involved in obtaining and passing of status information primarily dealing with program matters, would not be assumed by the proposed project manager. Although the project manager will be involved in both funding and status reporting his concerns will be project orientated rather than program orientated. There will still be a need to coordinate program funds and report status on program matters. For the sake of this discussion it will be assumed that the proposed project manager will assume 75 percent of the current project manager's work effort. Since the remaining functions are overall program matters, they could be absorbed by the current Acquisition Coordination Office (see Figure 16).

There were 95 personnel in the project management offices on 31 December, 1974. By this logic 75 percent of these personnel would be freed by implementation of the proposed project manager concept. This would amount to 71 personnel and include 34 project managers and 37 support personnel.

C2.4.2 <u>DESIGN DIVISION</u>

The proposed model would assume most all of the management tasks the EICs is currently performing. Unfortunately, data was not collected on the distribution of the EIC work effort. However, the value of the relative effort assigned to each organizational component for each task was estimated assigning each component an equal value for equal work. As such the relationship between the estimated relative effort for project managers shown in Table 30, and the effort they actually expended, should have some applicability to EICs. Using the logic, a ratio of 1.1 project managers to each point of relative effort can be derived (34/31 = 1.1).

This equates to 46 EICs (42 x 1.1 = 46). Making the assumption that the portion of the EICs work which is being displaced has half the requirement for support personnel that the project managers require (this is probably conservative); 25 support personnel would be freed bringing the total, for the Design Division to 71 personnel.

C2.4.3 CONSTRUCTION DIVISION

In terms of the functions the proposed project manager will assume, Table 30 shows that there is little direct impact on the Construction Division. However, the creation of the expanded project manager responsibilities will eliminate the need for a number of the personnel in the construction branches who currently perform a council/coordination service for ROICC offices and maintain a body of information concerning ROICC activities. (B3.5.1) As the project manager would have direct access to all components of the Acquisition Department and would be the source of information for all matters concerning his projects this Construction Division function would no longer be needed. As discussed in sub-chapter B3.5.2 the Chesapeake Division dissolved this function some time ago. Based on the 31 December, 1974, manpower figures

there are 9, 10 and 19 staff personnel in the Northern, Southern and Western Divisions' construction branches respectively. Although implementation of the project manager model would not free all the personnel in the construction branches, as these personnel perform other functions, it would free at least half, which would total 19 personnel. This would reduce the three Construction Divisions by 28 percent.

C2.4.4 ROICC OFFICE

All of the proposed project manager functions which are currently performed by the ROICC office are performed by either CEC officers or engineers of which there were 184 on 31 December, 1974. Using the logic derived in sub-chapter C2.4.1 and applying the ration of 1.1 to the value of the estimated relative effort in Table 30, 59 man years is obtained. This is 31 percent of the CEC officers and engineers. Again, assuming half of the support personnel 31 would be freed for a total of 90 personnel.

Implementation of the project management model would have a significant effect on the current ROICC operation. For EFD projects it would essentially limit the ROICC responsibility to providing inspection forces, although in the case of local OICC contracts it would not substantially change the ROICC's

present function, of performing contract administration as well as inspection.

However, as the EFD contracts amount to 90 percent of the workload, in terms of construction dollars, the ROICC's responsibility would be significantly reduced. As such it is recommended here that the title ROICC be eliminated altogether and the "inspection office" placed under the Construction Division which already provides the ROICC offices with many of the services of a functional division.

This would also facilitate consolidating the inspection offices suggested in sub-chapter B4.4.5 which would allow for a greater ability to adjust to the relative workload changes of stations in the same geographical area, and allow for consolidation of management personnel.

C2.5 LOCATION OF THE PROJECT MANAGER, ORGANIZATIONALLY AND GEOGRAPHICALLY

In considering where to place the project manager both organizationally and geographically two factors appear to be predominate. First there must be direct line of communication and accountability between the Acquisition Department Head and the project manager to even be considered in the framework of the way business is currently conducted. The second is

that the majority of the action, from the project manager's standpoint, is at the site not in the EFD. The customer, the construction contractor, the A-E, and the inspector are all at the site. (It is NAVFAC's policy to select a local A-E whenever possible.) Although this would require the EIC to travel to the site frequently the additional cost could be largely offset by not having to pay the A-E to travel to the EFD (both costs are charged against the same fund source). In addition this would have the second benefit of allowing the EIC to get into the field far more frequently and provide him or her with a greater opportunity to receive feedback from the field first hand.

Although not previously discussed, one of the major problems with the current organization is that the customer must deal with three NAVFAC representatives; the project manager, the EIC and the ROICC. Although some customers are represented by the 140 plus Public Works Officers in the area covered by the four EFDs, 53 of which are also ROICCs, a number of other customers who do not have Public Works Officers deal directly with the EFD and the ROICC. This may well

be at least a partial cause for the fact that the Acquisition Department Heads stated (Table 16) that the major category of problems experienced in the design and construction processes were customer problems. The proposed organization would condense the customer's contracts to one NAVFAC representative and would put this representative at the site, where communications between the project manager and the customer could be face to face in the local environment. To further this communication the project manager should be responsible for all of a customer's projects. This would provide continuity and allow the project manager to become familiar with the full range of the customer's problems and needs.

In terms of the project manager's organizational position his present position allows for the prerequisite, direct access to the Acquisition Department Head and provides for a horizontal relationship with the Design, Contract and Construction Divisions, which is also essential. Adding the project manager to the ROICC's staff would just place an unnecessary organizational element between the project manager and the Acquisition Department Head, and result in diluting the project manager's effectiveness. Another significant advantage of this

proposal is that it puts personnel responsible for design and construction on one team which should clarify responsibilities and loyalties. As most ROICCs in the current organization have a primary duty on the staff of one of the ROICC's customers it is not always clear whose team the ROICC staff is on and which set of implicit goals should be served. It has been the author's experience that this conflict of loyalties can significantly effect morale and priorities and hence the effectiveness of the ROICC office. The lack of clear concise well defined goals was, in the opinion of 96 percent of 1275 senior executives of companies in the manufacturing and service industries surveyed in a 1974, the major cause of poor productivity.(23)

Figure 29 shows an organization chart for the present organization. Figure 30 shows the proposed project manager organization. A comparison of these two charts alone, makes a strong argument for the proposal.

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23. Herman S. Jacobs and Katherine Jillson, <u>Executive Productivity</u>, p.2

FIGURE 29

CURRENT ORGANIZATION FOR FACILITIES ACQUISITION

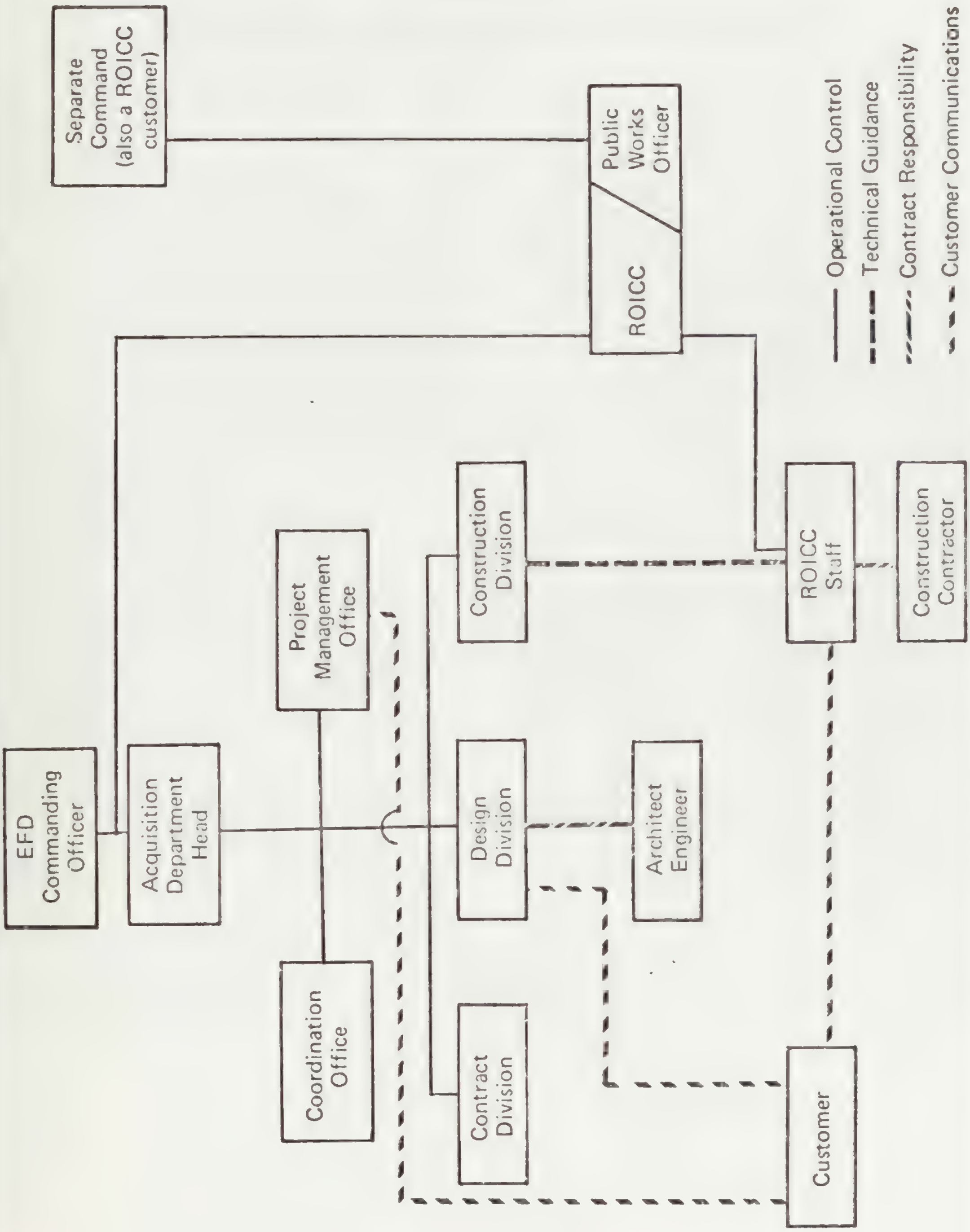
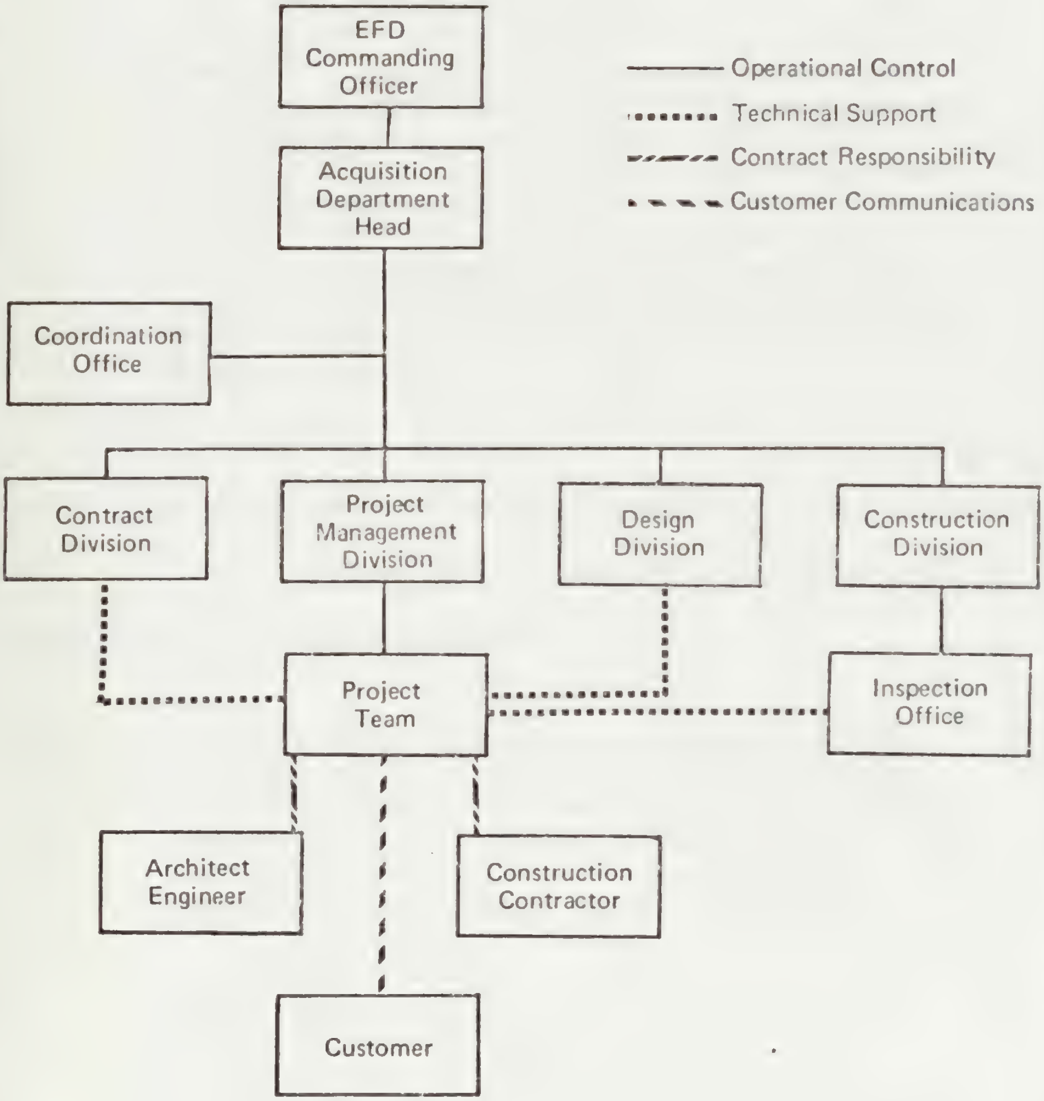


FIGURE 30

PROPOSED ORGANIZATION FOR FACILITIES ACQUISITION



C2.6 QUALIFICATIONS OF THE PROJECT MANAGER

The literature on project management organizations stress that the project manager's job is a difficult job requiring unusual skills. John Steward states:

> "He (the project manager) must be able to function on the project as a kind of general manager in miniature. He must not only keep track of what is happening but also play the crucial role of advocate for the project. Even for the seasoned manager this task is not likely to be easy. Hence it is important to assign an individual whose administrative abilities and skills in personal relations have been convincingly demonstrated under fire." (24)

Paul R. Lawrence and Jay Lorsch, both Professors at the Harvard Business School, conducted an extensive study dealing with the qualities of what they call an "integrator". They reported:

> "In the more effective (organizations) the integrators are influential because of their knowledge and experience, while in the less effective organizations they are influential only because of the formal authority or their positions."(25)
>
> One common failing of the less well-integrated organizations is their tendency to assign young managers lacking sufficient experience in all of the facets of the business to those positions. . .

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24. Steward, Op. Cit., p. 63
25. Paul R. Lawrence and Jay W. Lorsch, "New Management Job: The Integrator," HARVARD BUSINESS REVIEW November - December 1967, p. 146

Our evidence suggest that it really does not lead to effective integration."(26)

An "...important characteristic of effective integrators is that their orientations and ways of thinking strike a good balance between the extremes of the members of the specialized departments whose efforts they are integrating." (27)

"Our evidence indicates that, to be effective, an integrator needs to think and act in ways which evenly balance the highly social and the highly task orientated behavioral patterns of the units he is attempting to link." (28)

To be able to function as a minature general manager the project manager must have management experience. To gain influence over those he is integrating he must have the technical knowledge necessary to deal with (not design) all aspects of the project. Ideally he should have experience in both the design and construction processes. He should have an orientation that will balance the design, construction and customer orientations, and finally he should have the ability to link the behavioral patterns of the various players. Although no group fits all of these qualifications the Civil Engineer Corps Officer at mid career comes closer than his civil service counterpart. As a whole he has

26. Op. Cit, p. 147
27. Ibid
28. Ibid, p. 148

much more management experience, he usually has a technical post-graduate degree, and he has had experience with at least some aspects of the design and construction processes. Through his education he has gained the general orientation of the engineer, with his experience in several facility orientated jobs within the Navy he has probably worked several times with civil service personnel and should understand their orientation, and most important with his training and experience as a naval officer he has the potential for better understanding the operational needs and behavioral patterns of his customer.

In terms of fitting specific projects to specific personnel there are two major considerations; the technical nature of the project; and its complexity, size, value and importance. The former would require where possible, matching personnel with specific technical capabilities to the projects requiring those capabilities. As the nature of the customer's businesses usually result in facilities of a similar type, this would not generally conflict with assigning all of one customer's projects to one project manager. The second consideration would require assigning

more senior and experienced personnel to the larger more complex projects.

One of the most important elements of the project manager principle is accountability. In order to be fully accountable a project manager should follow the project from the first phase of design through a post-construction evaluation. Obviously in order to maintain a level of work it may be necessary for a project manager be assigned a number of projects in different stages. However, the assignment and rotation of the project manager could coincide with the beginning and ending of major projects.

In the author's opinion there would be no difficulty finding volunteers to make the three to four year commitment that large projects would require. Particularly officers who have just completed a post-graduate program in a engineering area, would jump at the chance to put their newly acquired knowledge to work, at a level where they could get involved in all aspects of project development. In return this would further strenghten the justification for technical post-graduate education. The project manager's job is also an extremely challenging management job and should equally interest whose who are more management orientated.

An added benefit of assigning CEC officers to the project manager job is that it would prove an invaluable training ground for the Acquisition Department Head job and the jobs in the upper levels of an overseas OICC or an OICC established for a specific project such as the OICC Trident.

C2.7 NUMBER OF PROJECT MANAGERS REQUIRED

It is of course not possible to determine the number of project managers required for a given workload without thoroughly examining the workload. However, an "order of magnitude" figure can be derived by examining the workload of the present project managers and the information in Table 30.

Table 5 showed the estimated projects for each project manager during FY 75. Figure 8 showed that the FY 75 workload of the Southern and Chesapeake Divisions was significantly over their average where the workloads of the Northern and Western Divisions were much closer to the average. It will therefore be assumed that the project workload of the project managers in the latter two EFDs are more representative of what the project workload should be, which is 29 projects per project manager. As such it

would have taken 55 project managers to handle the FY 75 workload represented in Table 5. In sub-chapter C2.4.1 it was estimated that the proposed project manager would assume 75 percent of the tasks of the present project manager. This would mean that they would assume the equivalent work of 41 project managers (55 x .75 = 41).

Table 30 showed the 31 units of estimated relative effort applied by the project managers. This is about 1/4 of the total 135 units of the estimated relative efforts of all organizational components. It follows that the equivalent effort of 41 project managers would equate to about 1/4 of the total effort the proposed project manager would undertake, as the relative effort values were assigned to all organizational components on the same basis. This would mean that 164 project managers would be required (41 x 4 = 164).

A second way of arriving at the number of project managers required would be to use the ratio of 1.1 project managers to the value of estimated effort, derived in sub-chapter C2.4.2. Using Table 30 this would equate to 146 project managers (133 x 1.1 = 146). This is lower than the previous figure as it does not take into account the adjustment for apparent under-

staffing of the Southern and Chesapeake Division's project management offices during FY 75.

On 31 December 1974 there were 106 CEC officers in the Acquisition Departments of the four EFDs. Of these, 95 were in the field. The 95 were comprised of 57 Lieutenants and above with at least four years experience in the Navy, and 38 below the grade of Lieutenant. Considering the characteristics of a successful "integrator" it is felt that the experience level of a Lieutenant is a minimum for the project manager job. The officers below the grade of Lieutenant could serve as assistant project managers extending the capability of the project manager and providing a training ground for a subsequent project manager assignment.

The one disadvantage of using a CEC officer in the project manager position is that he would only be assigned the job for a tour of two to four years in length and, as such, would have to turn over a number of uncompleted projects to a successor. At best the officer's tour length could only coincide with the beginning and ending of a major project. To overcome at least part

of the lack in continuity civil service engineers should be permanently assigned to each team. This additional staff would also be needed to handle the number of projects that would have to be assigned in order to achieve a near level workload.

Looking back at the discussion in sub-chapters C2.4.1 although C2.4.4 it was estimated that the following personnel would be freed from their project duties if the project manager concept were implemented.

TABLE 31 ESTIMATION OF PERSONNEL FREED FROM PRESENT DUTIES BY IMPLEMENTATION OF PROPOSED PROJECT MANAGER CONCEPT.

	Professional Personnel	Support Personnel
Current Project Management Office	34	37
Design Division	46	25
Construction Division	19	0
ROICC	59	31
TOTAL	158	73

SOURCE: Estimates derived in sub-chapters C.2.4.1 - C2.4.4

The estimate of 164 required project managers roughly equates to the 158 professional personnel identified in Table 32.

The 57 officers that are Lieutenants and above could be assigned as project managers and the remaining 101 professional personnel which would include the 38 officers below Lieutenant (civil service engineers could back fill the positions these CEC officers vacated in the inspection offices) could be assigned to the project management teams. The team sizes would vary depending on the workload, with the notion that each professional person increased the team's capacity to handle 1/158 of the total workload for the four EFDs. With 57 teams each team would have an average of 28-29 projects. At least one clerical person would be required on each team and perhaps a second clerk to handle reports on the larger teams.

As discussed it is essential to the success of this proposal that the project manager have access directly to the Acquisition Department Head and that he have access horizontally to the heads of the functional departments. As such it is essential that the project management organization not be vertically layered. For this reason it is strongly felt that there should be only one supervisor of project managers in each EFD.

Although the figures discussed here are very rough it is felt that they do represent the order of magnitude of both the project managers required and the number of personnel that would be freed by implementation of the model. It is also felt that even though the proposed project manager would perform tasks that are not currently being performed the personnel freed by this concept are sufficient in number and type to staff the proposed teams.

C2.8 MAKING PROJECT MANAGEMENT WORK

The project manager by nature of his position will be orientated toward project objectives. To achieve the most effective utilization of this management concept the pressures on the project managers should support this project orientation rather than subtract from it. On this point Paul Lawrence and Jay Lorsch state:

> "...in organizations where the integrators were highly effective, they reported that the most important basis for their supervisor's evaluation was the overall performance of the products on which they were working. Where integrators were less effective, the superiors evaluation was more on the basis of their individual performance.

> ...When they feel they are judged only on the basis of their performance as individuals, they may become so concerned with making decisions to please their supervisors or to avoid rocking the boat that they will easily overlook what is desirable from the point of view of their total product responsibility."(29)

The literature on the subject of project management points out the need to set performance objectives and to monitor and measure progress against these objectives. As the project manager's natural orientation is end results, it is important that the goals stress end results and not means.

In order to obtain commitment of the project manager it is important, as discussed, that he have the opportunity to participate in the development of the goals, under which the project and he will be measured. In order to be meaningful and relevant these goals should have their genesis in the nature of the problem at hand. They should be formulated mutually and explicitly between the customer, the project manager and his team based on broad criteria provided by the Acquisition Department Head. The combined project goals of a project manager would be presented during each year's command management

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29. Lawrence and Lorsch, Op, Cit., p. 148

planning cycle to the Acquisition Department Head. The goals thus presented would be subject to negotiation. In a like manner the Acquisition Department Head would combine the goals he had negotiated with each of his project manager and present the EFD goals to the NAVFAC Program Manager within the general framework of the policy guidance provided him at the beginning of the cycle. Again the EFD goals would be subject to negotiation. Inturn the NAVFAC Program Manager would, as he does now, first present the combined EFD goals to the Command Advisory Board and finally to the Commander. Depending on the situation the process may require several iterations before the goals are firm. These same goals which should include time, cost and quality performance criteria, should be used at the end of the project to measure the degree of performance the end product achieved and thus the performance of the project manager and his project team. As such this system would comprise a post-construction appraisal system (the development of which is a FY 76 goal).

One of the major problems the project management organization would have to face is the fact that the primary loyalties of the EIC and the inspector will be to their functional organizations. This problem can

be lessened by assigning the same personnel to projects on the same team wherever possible. Two other techniques the literature suggests to handle this problem are the drafting of tasking agreements between personnel involved and the use of dual performance ratings. The former could take the form of an inspection plan where the inspector is concerned. In the case of the latter, performance ratings could be prepared for each EIC and inspector at the completion of each project and at all interim rating periods. The rating would then be reviewed and co-signed by the functional supervisor. Such a system is currently being used by the Air Force, on a fairly extensive basis in matrixed project organizations, similar to the one proposed here.

SECTION C, SUMMARY AND RECOMMENDATIONS

CHAPTER 3 SPECIFIC RECOMMENDATIONS

C3.1 CHAPTER OVERVIEW

The primary recommendation of this Thesis is that the project manager model detailed in Chapter C2 be implemented. As a result of the Thesis research a number of related areas were investigated This chapter in addition to recommending a trial test of the project management concept provides recommendations concerning these related areas.

C3.2 TEST THE PROJECT MANAGER MODEL AT THE CHESAPEAKE DIVISION

The Chesapeake Division appears to be the likely candidate for a test of the project manager model as they are currently operating closer to this concept than the other EFDs, with their workload made up with a high percentage of "state of the art" type research and development facilities where the coordination between design and construction is even more critical than it is on a normal project they could probably benefit most from the project manager model, they have a significantly higher turnover of personnel than the other EFDs which would mean that fewer personnel would have to be re-educated to implement the concept (in

an organization already disrupted by a high turnover the negative reaction to an organization change is bound to be less), and because of their small geographical area no personnel movements would be required. The test could be run during FY 77 which would give six months to plan the transition.

C3.3 DEVELOP EFD AND ROICC OFFICE GOALS WITH THEIR PARTICIPATION

Whether or not the project manager concept is accepted a participative method of arriving at a "first cut" for the goals should be adopted and the system should be extended to the ROICC level. There is strong evidence that EFD commitment to achieving the FY 75 goals varied significantly. There was also evidence which suggested that ROICCs may have goals different from their EFDs. Considering this and the notion presented in current managment literature that commitment is improved when subordinates participate in the goal setting process, it is felt that this technique should be utilized. Deviation in workload from each EFD's average should be taken into consideration during the negotiating phase of this goal setting process.

C3.4 GOALS SHOULD BE FOR ENDS NOT MEANS, IF POSSIBLE

Unless there is a necessity to track means such as congressional requirement to keep the cost of plans and

specifications within six percent of the estimated construction cost, and unless there is no other way of achieving this objective, goals should deal with ends and not means. In particular, goals should be established to improve the number of completion commitments that are met and to measure total project cost against the original estimate. Where it is considered necessary or highly desirable to impose requirements on means, such as the goal to utilize 25 percent of the available professional manpower in the Design Division on in-house design of major projects, the goal's short term effects should be monitored as well as the long range benefit in order to be able to assess the continuing cost/benefit relationship.

C3.5 EFD WORKLOAD SHOULD BE JUDGED CONSIDERING MORE VARIABLES

Sub-chapter B4.4 demonstrates fairly convincingly that when the distribution of work among the size categories of ROICC offices and the number of contracts are considered the EFDs' staffing levels appear significantly different than when just dollar levels alone are measured. With the tremendous amount of data in NAVFAC's integrated data base from which the CMS can draw, more factors could be considered without any additional input. Although the present practice of negotiating resources should certainly be continued

as all the variables could never be systemized, the equability of the point at which negotiations began could be improved.

C3.6 THE POST CONSTRUCTION APPRAISAL SYSTEM NEEDS TO BE MANAGEMENT ORIENTATED

As presented in sub-chapter B3.6 only 7 percent of the major problems experienced in the execution of the design and construction program are under the technical cognizance of the Design Division and only 10 percent are under the technical cognizance of the ROICC. With 61 percent of the problems falling in the management area or under management control outside the realm of the responsibility of these two organizational sub-units the post-construction appraisal system stands to gain most if it is used as a management tool. The law of diminishing returns suggests that it will be very difficult to make a significant improvement on 10 percent of the problems and that much more progress can be made on the category which includes 61 percent of the problems. If used as suggested in sub-chapter C2.8, the system would be an integral part of the overall management by objectives systems. Although there is some value in recording problems and attempting to get the information to a designer at some point in the future who can make use of the information this potential for payoff is small and as such should clearly be

treated as secondary.

C3.7 A LICENSED ENGINEER SHOULD ATTEND ALL FINAL INSPECTIONS

Sub-chapter B4.6.2 provided evidence which suggested that inspectors were the only NAVFAC personnel at about half of the final inspections held by small ROICC offices and the only representative at about 30 percent of the final inspections held by medium sized offices. It is recommended that a licensed engineer be required to attend every final inspection with a construction cost greater than $2,000 and to certify, in writing, that his inspection indicated compliance with the plans and specifications.

C3.8 INCREASED ATTENDANCE OF THE CUSTOMERS AT FINAL INSPECTIONS SHOULD BE ENCOURAGED

Although NAVFAC's Contract Manual (P-68) only requires that the customer attend final inspections for contracts over $25,000 it suggests that ROICCs be urged to encourage customers to attend all final inspections. Sub-chapter B4.6.2 reported the results of the ROICC survey which indicated that the customer only attended 38 percent of the final inspections held by small sized ROICC offices and 70 percent of those held by medium sized ROICC offices. In light of these statistics, it is recommended that the importance of the customer's attendance at final inspections be reemphasized.

C3.9 THE BENEFIT OF REQUIRING THE A-E TO PERFORM A MORE THOROUGH SITE INVESTIGATION NEEDS TO BE STUDIED

Table 9 shows that in the opinion of the 44 ROICCs surveyed, 42 percent of the problems in the plans (the largest category) resulted from inadequate site investigation. As site investigation is not part of the six percent restriction on the cost of plans and specifications, the A-E could be required to do more in this area. It is recommended that a study be commissioned to determine the extent of current losses occurring as a result of inadequate site investigation and to determine the cost of adapting alternate policies.

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APPENDIX A

I would like a copy
of the survey results.
Send it to ______________
(Name)

____

Please return by
1 August 1975
to LT G. A. PARKER,
CEC, USN
26 San Jose Terrace
Stoneham, Mass. 02180

1. Context:

Although the questioner, in several places, appears to ask for precise information, I full realize that providing it would be a monumental task, and ask only, that you provide your best estimate. Being on this end of the quesionnaire I am afraid I have violated what has bothered me most about questionnaires on your end, its too long, too detailed and presumes to be able to classify all the answers. Unfortunately, I don't know how to get around these problems and still obtain meaningful information. Please bear with me and try to fit your situation into the category that most closely approximates it. If you can't please leave the question blank.

As I have tried to indicate by the wording of the questions, it is recognized at the top, that most offices don't have theresources to do all they would like to. Even so, in your shoes, I felt guilty that I wasn't squeezing more out of the system, and as such I might have hesitated in answering some of the questions frankly. Please don't. Needless to say, if the picture is distorted any action based on it won't be very effective.

On a number of questions I have asked "on how many of your active contracts during FY 75 did_______." Some of the questions refer to the design stage others to contract close out. Its intended that all such questions be answered in relation to the total number of active contracts your office administered in FY 75, recognizing that some of these contracts had their beginning in FY 74, and others will extend into FY 76. (see question 2F)

If you could forward a copy of your organization chart with the survey it would be greatly appreciated.

2. General Information

A. What is your grade?_____________

B. Are you a full time ROICC/Senior AROICC_______. or is this responsibility an additional duty_________.

C. Have you had previous OICC/ROICC experience? Yes____ No____

D. How many months have you been in your present job?________

E. What was your total WIP (all fund sources) for FY 75?_________________

F. How many active contracts did you have during FY 75?_____________(figures to include all contracts that were active at any stage during FY 75)

G. What was your average onboard strength for FY 75 by the following classifications? By the same classifications, if you were in charge of one of several similar offices in a large private corporation, which performed a ROICC function, and your performance was measured against that of your peers on the basis of the quality and quantity of your output with relation to your cost, what additional personnel would you hire, and which personnel (types not individuals) would you let go? Assume FY 76's workload is expected to be the same as FY 75, and officers are personnel with equivalent capabilities of ENSs and LTJGs.

	Average Onboard FY 75	Additional Personnel You Would Hire	Personnel You would Let Go
Full time officers			
Engineers, GS-11 and above			
Engineering tech's GS-11 and above			
Contract administrators/ specialists GS-11 and above			
Supervisory Construction Reps			
Other Construction Reps, GS-11 and above			
General Construction Reps/Inspectors GS-9 and below			
Specialized Construction Rep/Inspectors GS-9 and below			
Other Technical personnel GS-9 and below			
Procurement and Clerical			
Other			

H. At how many remote sites, in excess of 45 minutes by vehicle, did you have inspectors assigned on a full time basis during FY 75?

____

I. Is your office more than two hours driving distance from the EFD. Yes____ No ____

J. On how many of your active contracts during FY 75 did you provide your customers with an original BOD determined in the following manner? (total should equal, total active contracts FY 75)

_____A BOD which was the same as the contract completion date, whether or not it was qualified.

_____An estimated BOD, which was not the same as the contract completion date and was based on your knowledge of the situation including your expectations for change orders and other eventualities.

_____A firm BOD, which was promised by the EFD, or was otherwise determined by circumstances beyond your control, and without the benefit of your counsel.

_____A firm BOD, which was promised by the EFD, but one in which your office played a significant role in determining.

K. What percentage of your contracts that were completed in FY 75 were completed on, or before the original BOD you furnished the customer?_____ (It is my guess that the average is less than 10%)

3. Plans and Specifications

A. At what design stage did your personnel participate in design conferences and reviews during FY 75? (check applicable stages for each category)

	Slate Selection or Fee-Negotiation	30% reviews (60% AF)	Other Significant meetings	100% reviews
Not at all				
On a few major projects				
On most major projects				
On almost all major projects and significant minor projects				
On almost all projects				
I don't have sufficient resources to attend all the design conferences I would like to. If I had sufficient resources I would attend the following conferences for most projects.				

B. To what degree is it your policy to review P&S and furnish comments to the EFD or station designers? (check one. Note, site inspection in conjunction with reviewing P&S's is covered in a separate question)

____ Our policy is to perform a general review identifying repeated construction problems.

_____ Our policy is to perform a thorough review including reviewing functional and technical items.

_____ Our policy is to perform a general review on all projects and a thorough review on projects we feel are likely to have problems.

B1. On what percentage of the projects you awarded during FY 75 were you able to fulfill your policy?_______

B2. On what percentage of the projects you awarded during FY 75, were you not able to perform at least a general review before the bidding stage? __________.

B3. On what percentage of the projects you awarded during FY 75 were you forced to manage "by exception" without the benefit of at least a general review?_______

B4. On what percentage of the projects you awarded during FY 75 were your personnel able to at least familarize themselves with the P&S at the 30% review stage?_______On what percentage of the projects you awarded during FY 75 did you receive P&S at the 30% stage for review?_______

B5. On what percentage of the projects you awarded during FY 75 were most of the comments you generated incorporated into the final design? (Place percent after both organziations. Note, combined number should be equal to, or less than the number in question B1).
EFD________________Station Design__________

B6. On what percentage of the projects you awarded during FY 75 were you able to afford the resources to have your personnel visit the site, with the plans, as part of the ROICC design review?_______________

C. On how many of your active contracts administered during FY 75 did personnel from the EFD design division or from the A-E visit the job solely for the purpose of seeing how the design turned out?_____________

C1. On how many of your active contracts administered during FY 75 did personnel from the EFD design division or from the A-E visit the job to solve specific design problems?__________

D. The Deficiency Analysis Data System (DADS) has consistantly shown, over the last four years, that

approximately 75% of the problem areas identified as being in the plans and specifications are in the plans. Based on your experience what percentage would you assign to the following problems? (total to equal 100%)

____Lack of adequate site investigation and a thorough understanding of the peculiarities. of the site or station.

____Lack of full understanding of customers needs.

____Just plain poor design (to include everything not listed above)

E. How many A-E contracts for the production of plans and specifications was your office assigned the responsibility to administer during FY 75?__________

4. EFD Relations

A. How many times did the following EFD personnel visit your office or projects during FY 75?

	0	1	2	3	Several Times	Frequently
CO/XO						
09A/09A1						
09A2 Personnel						
05 Personnel						

B. Considering the normal day to day business the ROICC office, as a whole, conducted with the EFD during FY 75, how would you rate the relative frequency of written, telephonic, and verbal communications (incoming and outgoing) with the following EFD codes? (check frequency classification for each code. Note, this question is attempting to identify who communicates with whom, without regard for subject).

	Very Seldom	Seldom	Periodically	Frequently
CO/XO				
09C				
09A/09A1				
09A2 Personnel				
05 Personnel				
04 Personnel				
02 Personnel				
01 Personnel				

C. Considering the normal day to day business of the ROICC office, as a whole, conducted with the EFD during FY 75, how would you rate the relative frequency of outgoing written, telephonic and verbal communications with respect to the following subject areas? (check frequency classification for each category. Note, items such as change orders may include questions of scope as well as funds)

	Very Seldom	Seldom	Periodically	Frequently
Command, including passing/receiving info. on high interest projects, staffing levels, major policy, etc.				
Legal, including contract interpretation, claims, etc.				
Project funding				
Contracts, including bid procedures, ASPR, scope				
Inspections, labor relations, administrative, safety, including training, CQC, reports, etc.				

	Very Seldom	Seldom	Periodically	Frequently
Engineering/ Design				
Personnel Matters				

C1. Considering the normal day to day business the ROICC office, as a whole, conducted with the EFD during FY 75, how would you rate the relative frequency of incoming written, telephonic and verbal communications with respect to the following subject areas? (check frequency classification for each category)

	Very Seldom	Seldom	Periodically	Frequently
Command including passing/receiving info. on high interest projects, staffing levels, major policy, etc.				
Legal, including contract interpretation, claims, etc.				
Project funding				
Contracts, including bid procedures, ASPR scope				
Inspections, labor relations administrative, safety, including training, CQC, reports, etc.				
Engineering/ Design				
Personnel Matters				

D. How would you rate the value (not quality) of the coordination function the construction division, Code 05, performs in terms of their help to you in conducting your day to day business. (check appropriate degree. Note, question is intended to address Code 05's coordination function only and not their other responsibilities).

(Highly Detrimental)				(No Value)				(High Value)
-4	-3	-2	-1	0	1	2	3	4

5. Inspection

A. Did your office develop formal written plans for Navy surveillance inspection on CQC contracts or for inspection on other contracts, during FY 75? (check one. Note, I am defining a surveillance inspection plan as one that includes, in detail, what will be inspected, how, when and by whom).

____No, I don't have the personnel with the capability/time to prepare meaningful plans but I would if I did.

____No, I believe, with proper supervision, that most inspectors are capable of doing an adequate job without a formal plan.

____Yes, I used plans on____contracts during FY 75 but because of lack of personnel with the time/ capability to develop meaningful plans they have met with only limited success.

____Yes, I used formal plans on____contracts during FY 75 and I believe that they have resulted in a significant improvement.

B. On how many of your active contracts during FY 75 did you have personnel with the time to develop and utilize a checklist of all required submittals, tests, and shop drawings?____________

B1. On how many of your active contracts during FY 75

did you have personnel with the time to develop checklists or otherwise conduct a thorough check to insure that all maintenance manuals, warranties, certificates, as-built drawings and other administrative contract requirements had been compiled before the final release? ________________

C. Did your office use statistical methods or similar sampling/decision making techniques to optimize your inspection effort, during FY 75?

____No, but I would if I had the personnel with the capability and training to use these tools in a meaningful way.

____No, I think the present system is adequate.

____Yes, but only with limited success, because I don't have personnel trained in this area.

____Yes, I think they are very useful.

D. Did you use team inspection procedures for other than final inspections on contracts administered by your office during FY 75? (check one. Note, I am defining team inspection as the utlization of group of specialist to perform indepth inspection at the critical points in a project's construction)

____No, I don't have sufficient specialized capability on my staff to make team inspection worthwhile on a routine basis. However, if I had the capability I would use it frequently.

____No, I think that inspection performed by the job inspector along with periodic inspections by other members of my staff are adequate for all but the most complicated facilities.

____Yes, but after experience I don't think team inspection is worthwhile except on high complex facilities or on projects that have significant design or contractor problems.

____Yes, but only with limited success, as I don't have adequate specialization within my staff.

____Yes, I have used team inspection on a number of projects and found this technique to be very useful.

F. On what percent of the final inspections your office performed did the following personnel participate. EFD 05 personnel_____,EFD, 04 personnel_______A/E_________,customer/station engineers or specialists_______.

F1. How many of your active contracts during FY 75 did the following personnel participate in routine inspections <u>other than</u> the final inspection? EFD 05 personnel (excluding safety)__________. EFD 04 personnel_________A/E__________, other EFD personnel__________, customer/station engineers or specialists________.

G. On what <u>percentages</u> of the contracts administered by your office during FY 75 did you employ the following techniques for the final inspection? (Assign a percent to each category. (Total should equal 100%)

____Developed and used a thorough checklist/plan listing all items needing inspection.

____Developed and used general checklist/plan listing the most critical items needing inspection.

____Relied on the experience of my staff engineers and inspectors, along with the customer/station technical personnel, who attend most final inspections.

____Relied on the experience of my inspectors along with the customer/station technical personnel, who attend most final inspections.

H. On how many of your active contracts during FY 75 was it necessary to employ one or more of the following contract provisions to force compliance. (number of contracts on which each provision was utilized).

____Removal and replacement of defective materials or workmanship.

____Witholding of payment.

____Removal of incompetent personnel.

____Stopped portions of the work due to defective performance/materials/equipment. (excluding safety)

____Formally threaten termination.

____Termination.

I. On how many of the ____ CQC contracts you administered during FY 75 did you experience the following situations. (A contract may fit one or more situations)

____CQC program worked generally well.

____The CQC plan was a <u>useful</u> tool which was used on a day to day basis.

____The CQC plan was not very useful and was not used on a day to day basis.

____The CQC Rep, did not have adequate experience due to availability of qualified personnel/lack of experience provisions in the contract.

____The CQC Rep. did not adequately exercise his authority.

____My personnel did not have the adequate time/ capability to perform the level of surveillance that was necessary to require a really effective program.

____The general contractor was not behind the program.

J. What percent of your construction Rep's. time during FY 75 would you assign to the following functions: (total should equal 100%)

____Matters concerning labor laws

____Safety

____Inspection of the work

____Inspection of contractor submitted reports/material

____Coordination/scheduling, utility outages, etc.

____Resolving discrepancies in P&S

____Reviewing P&S

____Paper work

____Other

K. On how many of your active contracts during FY 75 were you able to afford the resources to develop a list of long lead materials/equipment and track the contractors progress toward getting them a site?________. On how many contracts would have this have been desirable?__________.

L. On how many of your active contracts during FY 75 did you or the EFD order/contact long lead materials or equipment separately, before the construction contract was advertised?__________. On how many contracts would have this been desirable?________.

APPENDIX B

1 July 1975

Dear ROICC/Senior AROICC:

Before coming to MIT last spring I completed a two year tour in the area ROICC office, NAS Jacksonville. As a result of this experience and the thought I have given the subject since, it is my personal opinion that there are three areas which need attention:

1. Plans and Specifications . I believe that a significant percentage of the problems experienced at the ROICC level with plans and specifications can be attributed to the fact that there is very little continuity between design and construction in the way we currently do business. I believe that if design and construction worked more closely as a "team" throughout the life of a project, many of our current problems could be eliminated.

2. EFD Relations. In carrying out its assigned mission the Construction Division, Code 05, generally acts as the central point of contact/coordination between the EFD and the ROICC offices. (less true for CHESDIV) In my opinion, this serves only to further remove the source of information/council/ guidance, the ROICC is seeking and as such is more of a detriment than a help. I believe that the benefit the EFD derives from having a single source of information on ROICC activities needs to be re-examined with relation to the effect this procedure has on ROICC operations.

3. Inspection. Although text book facts such as "about 80% of construction problems accure in 20% of the product components" are intuitively understood, as well as, which portions of which components normally cause the most problems, its been my experience that this knowledge is not utilized on a consistent, planned basis. With ceiling points highly restrained and with an increasing MCON program, I think more than ever, we need to develop planning techniques which will allow us to schedule the right type of inspection at the right time. I believe that personnel, in the field, with the capability and training to conduct meaningful inspection

planning would allow us not only to do more with our limited resources, but to do it better.

The attached questioner is designed to determine, to the degree that a survey of this type can, whether or not there is evidence to support my claims. The results of this survey will become part of my Thesis which is being sponsored by the Assistant Commander for Construction, Naval Facilities Engineering Command. A statistical summary of the survey results by EFD and size of ROICC office, will be reported to him.

I know only too well how busy you are, especially at this time of the year. Its with hesitation that I ask for your time to fill out the enclosed questioner. However, I am sure you will agree, if our system is to remain viable it needs to be continually reassessed, and its just as important to validate that the present system is working as it is to identify and attempt to solve its problems.

If you would like a copy of the results of the survey please so indicate on the questionnaire and I will gladly send one to you.

To a very large degree the success of my efforts count on your response. I would greatly appreciate having the survey returned by 1 August, 1975.

Your help is sincerely appreciated.

Very respectfully,

G.A. Parker
Lt., CEC, USN

APPENDIX C

7 August, 1975

Dear ROICC/Senior AROICC:

On 10 July, 1975 I forwarded a lengthy questionnaire and asked if you would help in what I felt was an important study by filling it out and returning it by 1 August, 1975. To date I have not received a response from your office.

I have received a 60% response which, as questionnaires go, is not too bad. However, in order to make meaningful comparisons between sizes of ROICC offices (large, medium, and small) and between EFDs I need a much larger sample.

Although the results I have tabulated so far indicate each ROICC has a slightly different way of doing business, as each EFD does, there is a surprising consistency in several areas. Correlating the results by WIP per man, taking into account number of contracts and office size, is also yielding interesting results. I think the study will have a great deal of value at the NAVFAC level. I also think the study would be of value to each ROICC/Senior AROICC as will allow him to view himself with relation to others.

Again, I solicit your help in what I think is a valuable and worthwhile study. In case the original questionnaire has been misplaced, I have enclosed a second copy. If the questionnaire could be returned by 15 August, 1975, it would be greatly appreciated.

Thank you for your help.

Sincerely,

G. A. Parker
Lt., CEC, USN

APPENDIX D

QUESTIONS FOR TELEPHONE INTERVIEWS WITH THE ACQUISITION DEPARTMENT HEADS

1. The Deficiency Analysis Data System (DADS) has consistantly shown, over the last four years that approximately 75% of the deficiencies are in the plans. Based on your experience what percentage would you assign to the following categories: (Total to equal 100%)

__________ Lack of adequate site investigation and a thorough understanding of the peculiarities of the site or station.

__________ Lack of full understanding of customers needs.

__________ Lack of understanding of construction practices.

__________ Just plain poor design to include everything not listed.

2. The DADS discussed problems in the P&S only. What percentage of the total field problems the Acquisition Department becomes involved in, would you assign to the following causes:

__________ ROICC caused problems such as timely completion, or poor quality.

__________ Problems in the P&S which a more thorough design could have avoided.

__________ Customer caused problems such as customers changing their minds.

________ All others to include, unforeseen site conditions, national material shortages that were unknown at the time of the design, changed operational requirements that a customer could not have anticipated.

3. What percentage of the field problems, that are under the cognizance/general control of the ROICC, would you assign to the following problem categories:

__________ Inadequate inspection.

__________ Poor customer coordination/relations.

__________ Poor contractor relations. (Too easy, too tough, not working with contractor, etc).

__________ Poor contract administration procedures.

__________ Other.

4. What percent of the information you receive on ROICC operations comes from the following sources:

_________ Your personal observation.

_________ Project Managers.

_________ Construction Division.

_________ ROICC prepared reports.

5. If you had 20 more people, where would you put them:

_________ Coordination Office.

_________ Project Management Office.

_________ Contract Division.

_________ Design Division .

_________ Construction Division.

_________ ROICC.

6. How would you rate the value, to you, in performance of your everday operations, of the following code 05 functions other than safety and labor relations. (Rate on a scale of 1-5, with 5 the most valuable).

_________ Provide a readily accessable body of knowledge concerning project status/ ROICC activities.

_________ Collect data, coordinate and prepare status reports.

_________ Provide ROICC's with guidance and direction concerning inspection matters.

_________ Prepare ROICC staffing studies and generally oversee personnel matters.

_________ Coordinate the implementation of policy at the ROICC level.

7. What effect do the annual goals have on the way you do business with respect to local priorities.

_________ The major force.

_________ One of the major forces.

_________ A significant effect.

_________ A minor effect.

8. Have you established any formal goals for performance at the ROICC level, and if so what are they_____________.

APPENDIX E

QUESTIONS FOR TELEPHONE INTERVIEWS WITH PROJECT MANAGEMENT OFFICE HEADS

1. How many personnel were on board as of 31 June_______

2. How is your shop organized?___________________________

____

3. How many project managers do you have?______________

4. How many projects (average) does each project manager handle at a given time?____________________

5. What percentage of your project managers time would you estimate they spend performing the following functions:

_____Design Coordination, through contract award.

_____Construction Coordination.

_____Funding Matters.

_____Obtaining/passing status information.

_____Other.

6. To what degree do your project managers oversee the design?

_____On what percent of the A/E contracts does your project managers write the scope of work?

_____On what percent of the A/E contracts are your PMs designated OIC?

_____On what percent of the A-E slate and selection board do your PMs participate?

_____On what percent of the contracts does the EIC go through the PM to the customer?

____On what percent of the contracts does your PM attend the 30% design review?

____The 100% design review?

7. To what degree do your PM's participate in routine construction evolutions?

____What percent of the pre-construction conferences do your PM's attend?

____What percent of the projects does your PM see during construction?

____What percent of the final inspections do your PM's attend?

8. Do you need any more people to adequately perform your assigned tasks?________________

APPENDIX F

STATISTICS FOR LARGE ROICC OFFICES
(Figures in million dollars)

EFD/ROICC	FY 75 WIP	Man Years Expended (2)	Number of Contracts (1)	Future Workload (3)	Total Programmed (3)
NORTHERN					
Great Lakes	24.2	27	143	112.3	60.1
New London	15.7	20	75	87.7	45.9
SOUTHERN					
Charleston	17.3	21	166	144.9	93.2
Gulport	24.2	15	44	29.5	22.6
Jacksonville	22.5	27	167	312.0	132.1
New Orleans	25.4	18	75	119.9	43.7
Orlando	22.1	13	67	119.4	90.6
Pensacola	26.3	26	82	199.8	122.7
WESTERN					
Camp Pendleton	38.2	28	57	161.8	118.2
San Diego	46.3	53	193	915.4	316.3
San Francisco	17.7	23	54	268.5	63.7
CHESAPEAKE					
Annapolis	15.6	23	90	104.6	44.3
Washington, D.C. (Beltway)	37.0	21	64	39.7	16.3

SOURCE: (1) CMS June 1975 Report, NAVFAC, (2) Manpower Listings 31 December 1974, NAVFAC. (3) MILCON Data Bank as of August 1975, NAVFAC.

APPENDIX 6

STATISTICS FOR MEDIUM ROICC OFFICES
(Figures in million dollars)

EFD/ROICC	FY 75 WIP	Man Years Expended (2)	Number of Contracts (1)	Future Workload (3)	Total Programmed (3)
NORTHERN					
East Pennsylvania	7.1	10	83	32.8	15.7
Lakehurst	9.1	11	56	97.1	9.6
Newport	10.7	21	61	97.1	55.2
Philadelphia area	9.7	19	100	139.0	12.1
SOUTHERN					
Corpus Christi	12.9	14	67	82.4	40.5
Meridian	9.7	6	26	40.1	22.6
Memphis	10.5	10	22	83.3	45.5
WESTERN					
Adak	5.2	5	13	78.8	46.6
Bremerton	8.7	19	59	222.1	92.0
El Toro	6.8	11	27	41.6	36.2
Hawthorne	8.5	9	25	36.7	30.3
Lemoore	7.1	11	25	42.5	20.4
Long Beach	9.9	24	79	157.0	70.9
Moffit Field	6.7	7	25	36.0	13.5
North Bay	7.4	17	53	147.6	40.8
CHESAPEAKE					
Indian Head	5.2	7	58	25.3	12.7
Patauxant River	6.8	10	86	74.0	21.5
Quantico	5.8	12	64	57.2	45.7

SOURCE: (1) CMS June 1975 Report, NAVFAC, (2) Manpower listings 31 December, 1974, NAVFAC. (3) MILCON Data Bank as of August 1975, NAVFAC.

APPENDIX H

STATISTICS FOR SMALL ROICC OFFICE
(All figures in million dollars)

EFD/ROICC	FY 75 WIP	Man Years Expended (2)	Number of Contracts (1)	Future Workload (3)	Total Programmed (3)
NORTHERN					
Brunswick	2.9	6	33	16.2	6.7
Columbis	1.4	5	39	10.6	4.4
Crane	4.9	9	34	17.3	10.5
Griffis	2.2	3	29	9.3	4.6
Glenview	4.2	5	17	33.7	21.1
Mechnicsburg	2.4	4	21	19.8	8.4
New York City	3.6	14	54	19.0	5.9
Portsmouth	4.5	8	42	96.7	32.0
South Weymouth	1.6	5	47	18.6	9.5
SOUTHERN					
Albany	4.0	3	14	9.6	9.6
Beauford	3.0	4	37	20.0	16.4
Dallas	3.6	7	36	30.9	16.0
Key West	3.2	5	37	39.0	7.1
McAlester	3.3	5	16	19.8	10.2
Panama City	2.4	3	9	18.5	13.2
Paris Island	4.7	3	30	20.6	20.6
WESTERN					
Barstow	5.0	6	12	15.3	14.4
China Lake	4.0	9	23	33.7	16.4
Monterey	2.1	5	11	28.6	3.2
Point Mugu	4.2	9	63	81.4	41.2
Seattle	1.4	6	25	13.0	6.0
Twenty Nine Palms	3.4	9	14	29.0	28.9
Whitbey Island	4.0	8	14	82.8	31.8
Yuma	2.5	10	21	21.3	14.2
CHEASPEAKE					
Bethesda	3.1	2	45	10.9	10.8
Carder Rock	2.3	4	34	62.3	.6
Dahlgren	1.9	5	21	23.6	6.2
Naval Research Lab	4.3	7	44	53.2	20.0
Navy Yard	3.8	6	75	27.6	10.8

SOURCE: (1) CMS June 1975 Report, NAVFAC, (2) Manpower Listings 31 December 1974, NAVFAC. (3) MILCON Data Bank as of August 1975, NAVFAC.

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